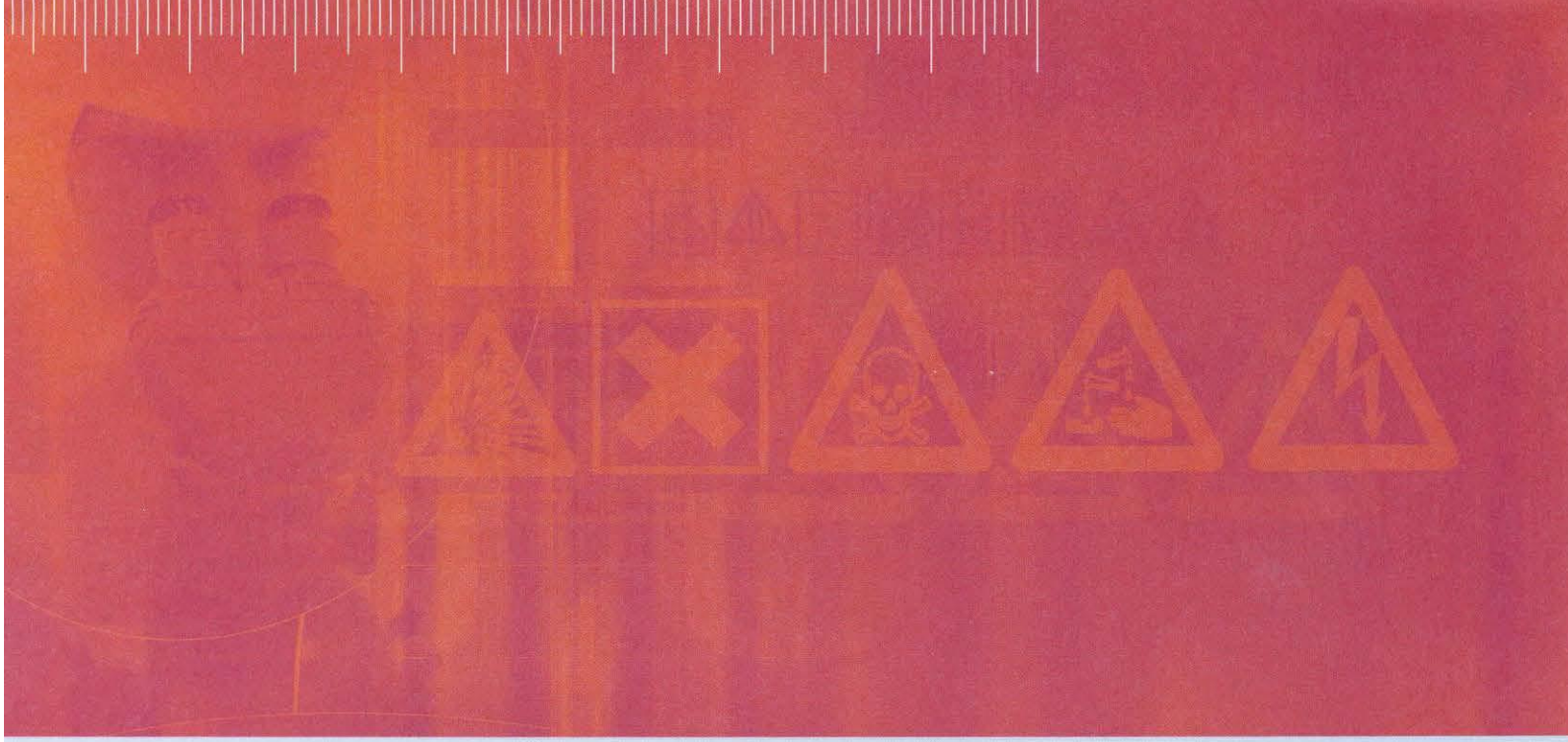

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HAZARDOUS SUBSTANCES FOR THE AQUATIC ENVIRONMENT IN INDUSTRIAL WASTE WATER RELEASES

National Action for Research and the Reduction of Releases of Hazardous Substances into Water Bodies (RSDE) by Classified Facilities - Second Phase

SUMMARY OF THE INITIAL MONITORING RESULTS

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SUMMARY OF THE INITIAL MONITORING RESULTS

Report prepared for the Ministry of the Environment, Energy and the Sea

List of people who participated in the study: Hervé Barré, Rodolphe Gaucher, Philippe Jouglet, Bénédicte Lepot, Christophe Lescot, François Lestremau, Caroline Marchand, Nathalie Marescaux.

PREAMBLE

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FOREWORD

The results of the first phase of the action (RSDE1) were published in 2007 (Report INERIS-DRC-07-82615-13836C).

This report has been prepared on the basis of data entered and available in a national RSDE database, managed by INERIS on behalf of the Ministry of the Environment, Energy and the Sea, as part of the second phase of the national action for research and the reduction of releases of hazardous substances into water bodies by classified facilities (RSDE2).

This is the final report of this second phase of the action (RSDE2). Therefore, it **CANCELS OUT** and **REPLACES** all interim reports and communications that have been previously released.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

AQUAREF	Laboratoire national de référence de l'eau et des milieux aquatiques/ National reference laboratory for water and aquatic environments
BDE	Bromodiphenyl ethers
BREF	Best Reference Document – Reference document on the best techniques available
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
WAC	Weighted average concentration per flow across all collected samples
HVOC	Halogenated volatile organic compounds
TOC	Total Organic Carbon
WFD	EU Water Framework Directive 2000/60/EC
COD	Chemical Oxygen Demand
HW	Hazardous waste
DEHP	Di(2- ethylhexyl) phthalate
DGPR	Direction Générale de la Prévention des Risques / Directorate-General for Risk Prevention
NHW	Non-hazardous waste
EDILABO	Electronic data exchange between sponsors and service providers (samplers and analysis laboratories) in the water domain
ADF	Average daily flow on all samples taken
GEREP	Gestion Électronique du Registre des Émissions Polluantes / Electronic Management of the Pollutant Emission Register
PAH	Polycyclic aromatic hydrocarbons
ICPE	Installation Classée pour la Protection de l'Environnement / Classified Facilities for the Environmental Protection
IED	Industrial Emissions Directive (2010/75/EU)
INERIS	Institut National de l'Environnement Industriel et des RISques / National Institute for the Industrial Environment and Risks
ISDND	Installations de Stockage des Déchets Non Dangereux / Non-hazardous waste storage facilities
QL	Quantification Limit
SM	Suspended matter
BAT	Best Available Techniques
ELC-BAT	Emission levels combined with the best available techniques
PNAR	Plan national d'action contre la pollution des milieux aquatiques / National Action Plan against the Pollution of Aquatic Environments
REACH	Registration, Evaluation, Authorisation and Restriction of Chemical substances (European regulation)
RSDE	Research and Reduction on the Release of Hazardous Substances into Water Bodies
SANDRE	Service d'Administration National des Données et Référentiels sur l'Eau / National Administration Service for Data and Standards on Water

SDAGE	Schéma Directeur d'Aménagement et de Gestion des Eaux / Master Plan of Water Development and Management
WWTP	Waste Water Treatment Plant
SVHC	Substance of Very High Concern
ELV	Emission Limit Value

LIST OF FIGURES

LIST OF TABLES

OVERVIEW

The action for research on and the reduction of releases of hazardous substances into water bodies (RSDE) by classified facilities subject to authorisation or registration, conducted in France at the national level between 2009 and 2015, is in line with the objectives of the Water Framework Directive (WFD) with regard to the progressive reduction and elimination of releases of priority substances and priority hazardous substances into water bodies.

This study presents the results of the exploitation of the “initial monitoring” data carried out as part of the RSDE2 action, by 3,722 classified facilities distributed in 41 industrial sub-sectors, on 112 substances that were being tested for.

The results of this study shed light on:

- the presence of substances in releases at quantifiable concentrations;
- the release levels (in concentrations and flows) of these substances;
- the proportion of sites whose releases exceed the thresholds for long-term monitoring actions and reduction studies, for which substances and in which industrial sectors;
- substances of global interest or for which targeted actions could be taken and the potential reductions in releases of these substances.

These results have been analysed globally and on a sectoral-basis, and detailed analyses for some substances are presented in this report. The overall results for each specific substance and industrial sector are also provided in two documents attached to this report (Reports INERIS-DRC-16-149870-01979B and INERIS-DRC-16-149870-01981B).

Key words: hazardous substances, priority substances, Water Framework Directive, aqueous industrial releases, ICPE, industrial emissions, chemical analyses, reduction measures.

ABSTRACT

The progressive reduction of emissions of hazardous substances to water bodies and achieving "good status" for all water bodies are two objectives of the Water Framework Directive. To contribute to these objectives, a national inventory of hazardous substances in industrial emissions to water bodies (called “action RSDE”) has been carried out in France between 2009 and 2015 on a national scale.

This study presents the results of the analysis of data gathered from the “initial monitoring” conducted during this inventory, from 3,722 industrial sites from 41 industrial sectors, on 112 substances that were tested for.

These results focus on:

- the substances identified in quantifiable concentrations in industrial waste water;
- the flow and concentration levels measured for these substances;
- the proportion of sites whose flows measured exceed “regulatory” thresholds implying the need to study solutions for the reduction of theses emissions;
- the substances considered of global interest or for which dedicated actions could be engaged and on possible reductions of these substances emissions.

These results were analysed on global and sectorial scales and a detailed analysis for some substances are presented in this report. The whole results for each substance and each industrial sector specifically are given in two reports annexed to the present document (Reports INERIS-DRC-16-149870-01979B and INERIS-DRC-16-149870-01981B).

Key words: hazardous substances, priority substances, Water Framework Directive, industrial waste water/releases, industrial emissions, chemical analysis, reduction measures.

OPERATIONAL OVERVIEW

To contribute to the achievement of the objectives of the Water Framework Directive (WFD, Directive 2000/60/EC of 23 October 2000) on the French territory (achieving good water status and reducing or even eliminating releases of hazardous substances into aquatic environments), a national action for research and the reduction of the release of hazardous substances into water bodies (RSDE) by classified facilities was launched in 2002 by the Directorate General for Risk Prevention (DGPR) of the Ministry of the Environment. The objective is to identify the industry's contribution to these emissions and, if necessary, to take the necessary management measures. This action, which is included in the national micropollutant plan[1], is part of a broader policy of protecting aquatic environments that also targets other potential sources of emissions, such as urban, agricultural, etc.

Overall, 112 substances were tested for in the releases, including substances targeted at the European level by the Water Framework Directive and other substances that were deemed to be relevant to be monitored at the national level (organic or inorganic substances: metals and metalloids, halogenated volatile organic compounds (HVOCs), polycyclic aromatic hydrocarbons (PAHs), etc.).

The first phase of this action (called RSDE1) took place from 2003 to 2007. This was a prospective phase carried out on approximately 2,650 industrial facilities which was the subject of an overall assessment that was published in early 2008. On the basis of these initial results, a second phase (called RSDE2) was introduced and formalised by circular in 2009.

The objective of this second phase is to extend it to classified facilities that have been identified as a concern in terms of aqueous releases, regardless of whether they are subject to authorisation or registration. This phase involved six campaigns of quantification of the flows of substances, carried out by the operators of each site, which were defined per industrial sector. Depending on the results of this initial monitoring, long-term monitoring, or even reduction studies of releases, have been prescribed to these ICPEs by prefectural order according to the significance of the releases compared to national criteria (threshold flow values defined for each substance) or local criteria (depending on the impact on the body of water).

The sampling and analysis operations for the substances under consideration have been carried out according to defined technical prescriptions to ensure the reliability and comparability of the data collected. The results of the measurement campaigns have been presented in an initial monitoring report for the inspection of classified facilities on the one hand, and via an online input tool to be stored in a database managed by INERIS on the other.

The reliability of the data has significantly improved as a result of the scope of action being defined upstream of its launch, together with a number of actions and controls being carried out during data collection, and downstream, before their exploitation. During the first validation of data, the percentage of correct base data was 6.5% in June 2010, which increased to 95% from July 2011. Frequently asked questions have also been made available on the website dedicated to the RSDE action.

In addition, an analysis of the feedback carried out on the verification of the metrological data made it possible to highlight the precautions to be taken when interpreting the results for certain substances.

[1] 2015-2021 National Micropollutant Plan to Preserve Water Quality and Biodiversity.

This report summarises the results of the initial monitoring conducted within this framework, on 3,722 sites selected after the data was validated, distributed over 41 industrial sub-sectors, at the national level. This number of sites is of the same order of magnitude as the number of "Water reporting" sites in GEREP, an annual pollutant reporting tool, out of a total of about 50,000 classified facilities subject to authorisation or registration. Overall, the data set can be considered as a representation of the main contributors to industrial aqueous releases at the national level.

The results of this study shed light on:

- the presence of substances in releases at quantifiable concentrations (given the current state of available techniques);
- the release levels (in concentrations and flows) of these substances;
- the proportion of sites where releases exceed the thresholds for long-term monitoring actions and reduction studies, for which substances and in which industrial sectors;
- substances of global interest or for which targeted actions could be taken and the potential reductions in releases of these substances.

These results have been analysed globally and on a sectoral-basis, and detailed analyses for some substances are presented in this report. The overall results for each specific substance and industrial sector are also provided in two documents attached to this report (Reports INERIS-DRC-16-149870-01979B and INERIS-DRC-16-149870-01981B).

55 substances were quantified at least three times by more than 10% of the sites. The most frequently measured substances are zinc, copper and nonylphenols, as well as octylphenols, 3 other metals (chromium, nickel and lead), decabromodiphenyl ether (BDE-209), chloroform, 2 PAHs (fluoranthene and naphthalene), 2 chlorophenols (2,4,6-trichlorophenol and 2-chlorophenol), monobutyltin cation, tributylphosphate and biphenyl.

Substances with the highest emission levels, in the 90th percentile (i.e. the value above which the highest 10% of releases are found), in both average concentrations and flows, are 6 of the 8 metals (zinc, copper, nickel, chromium, lead, arsenic), HVOCs (chloroform and methylene chloride), BTEXs (xylenes and toluene) and nonylphenols.

As regards priority hazardous substances, which are ultimately targeted by the emission phasing-out objective of the Water Framework Directive, it is noted that these substances are found in quantifiable concentrations by a minority of sites, with the notable exception of nonylphenols.

55 substances or groups of substances are released (by at least one site) at flow levels that exceed the long-term monitoring thresholds. Of these, 44 also exceed the reduction study thresholds[2].

The families of substances most affected by the long-term monitoring and reduction study actions are mainly metals, as well as HVOCs and alkylphenols. The most affected substances in these families are zinc, nickel, nonylphenols and chloroform.

In contrast, some substances are infrequently quantified and overall released in small quantities by all sites (such as pesticides, tributyltin cation, etc.).

In addition, the results show that releases from sites exceeding the reduction study thresholds represent more than 60% of the total flows emitted by all the study sites for the majority of substances, and even more than 80% of the total flows for 28 substances.

[2] The long-term monitoring and reduction study thresholds have been pre-defined in the Ministry of the Environment's note of 27/04/2011.

As regards the 3,722 sites selected for this study (in August 2014, after data validation) out of 4,821 sites for which the initial monitoring was recommended (as of October 2015):

- 897 sites (about 24%) have releases that exceed the long-term monitoring thresholds for one or more substances;
- 358 sites (about 10%) have releases that exceed the reduction study thresholds for one or more substances.

These are estimates of the monitoring and reduction actions (based on the results available in the database), obtained by comparison with the daily flow thresholds criteria that trigger these actions only. At the local level, other criteria relating to the impact of releases on the receiving environment are applied and result in the recommendation of additional actions on the ground which explains, in particular, the discrepancy noted with the data reported by the inspection of the classified facilities. Among these criteria, defined by the DGPR note of 27 April 2011, operators have the possibility of subtracting the "imported" flows from the water taken from the daily flow emitted by a site if the release is made into the same environment.[3].

On the basis of the indicators reported by the inspection of the classified facilities, the report submitted by the DGPR in October 2015[4] is as follows:

- 1,730 sites (about 36%) are involved in at least one long-term monitoring action for one or more substances;
- 640 sites (about 13%) are involved in at least one reduction study for one or more substances.

The differences between the figures presented in this study and those reported by the inspection of the classified facilities, in terms of the proportion of sites concerned by long-term monitoring actions and/or reduction studies, can be explained in particular by taking into account the local impact criteria of the releases on the receiving environment in the recommendation of these actions. These criteria were devised at the national level and applied on the ground at the local level but cannot be taken into account in this study because they are not included in the database that was used.

These analyses of the results confirm the interest of the approach chosen in the framework of the RSDE action, of which objective is to quantify emissions from all the sites, then target reduction efforts on the main national industrial contributors (contribution to the national reduction objectives resulting from the implementation of the Water Framework Directive) and towards the environments most directly affected by the ICPEs' releases (contribution to the WFD's objectives of good status of water bodies).

The overall results make it possible to clarify, according to the substances, to what extent releases of these substances are an industrial problem, and if they concern one or more industrial sectors, thus making it possible to target the most relevant actions at a national level (collective actions, or targeted actions at a few sites that mainly contribute to emissions).

It should also be noted that ICPEs are not the only contributors to emissions of hazardous substances into aquatic environments. In the strategies for reducing emissions of hazardous substances into water developed at the national level, actions also concern other families of contributors to releases (such as handicrafts, runoff, agriculture, etc.).

[3] Calculating this imported daily flow could not be done automatically in the database, the flows concerned were therefore not corrected within the framework of this study.

[4] Source: Ministry of the Environment, Energy and the Sea, on the basis of the indicators reported by the inspection of the classified facilities in the management software of the classified facilities S3IC in October 2015.

More broadly, the implementation of the national RSDE action also:

- led to improved practices for the collection and analysis of hazardous substances, and hence the quality of data;
- helped to define emission management measures at the local level (at river basins [5], site by site, etc.);
- helped to supply the RSDE studies carried out by several industrial branches on their industrial sectors on the basis of results;
- provided a significant and quality contribution to the inventory approach (and related reporting) of the emissions, releases and losses of priority substances to surface water required by the WFD in Article 5, on point releases from classified facilities on the one hand, and urban water treatment plants[6] on the other;
- contributed, within the scope of the ICPEs, to the national policy for combating the emissions of hazardous substances into water bodies implemented to meet the objectives of the WFD.

These results and the lessons learned over time as a result of the reduction studies are currently being exploited:

- on the one hand, in the context of preparing reference documents on the best available techniques (BREF) in order to take advantage of the knowledge acquired at the European level,
- on the other hand, in the context of the discussions initiated by the Ministry of the Environment concerning the possible revision of the opposable emission limit values[7] for classified facilities in light of these results.

[5] This report is a summary of results at the national level. The results at each basin may be more specific.

[6] A national action for research on and the reduction of releases of hazardous substances into water bodies (RSDE) was also launched on urban waste water treatment plants. The results of this action are available in the INERIS report entitled “Hazardous Substances to the Aquatic Environment in Releases from Urban Waste Water Treatment Plants - Review of the National Action for Research on and the Reduction of Releases of Hazardous Substances in Water Bodies by Urban Waste Water Treatment Plants (RSDE) - Summary of Initial Monitoring Results”, Partaix H., INERIS Reference-DRC-15-136871-11867E, Convention ONEMA - INERIS, 2016.

[7] Defined by ministerial orders.

INTRODUCTION

The purpose of this introduction is to present the structure of this report and the content of each section to guide the reader.

The report presents the study results of the initial monitoring of releases of hazardous substances into water bodies by classified facilities, as part of the RSDE action.

To do this, it consists of two main parts:

- **part 1** presents the **study and the working methodology**;
- **part 2** includes the **study results**.

Finally, **detailed results** by substance and industrial sector are available in **two documents annexed** to this report (Reports INERIS-DRC-16-149870-01979B and INERIS-DRC-16-149870-01981B).

The more detailed content of each of the parts and sections of the report is as follows:

- Part 1: presentation of the study and the working methodology:
    - Sections 1 and 2 present the context and objectives of this study as well as the national RSDE action, its objectives and its framework;
    - Section 3 is a discussion of the comparability and reliability of the results presented. It describes the work carried out and the framework implemented to guarantee the quality of the data used, in particular as regards the following aspects:
        - data collection and storage,
        - metrological control of the data,
        - additional checks / corrections of the collected and stored data.

      Feedback from these controls and uncertainties about the data used are discussed at each stage, to help the reader fully grasp the limitations of the results presented.
    - Finally, Section 4 describes the methods of calculating and aggregating the data used to present the results.

The elements presented in Part 1 are detailed to give a precise presentation of the study, the working methodology and the limitations associated with the results. Thus, this part of the report can be read in detail by readers who are already familiar with this area and/or those who are eager to deepen their knowledge of these aspects, which are necessary to fully understand the study. Readers who want to get to the results more quickly can skip ahead to Part 2 of the report.

- Part 2: Study results:
    - Section 1 gives a descriptive analysis of the data set (number of sites affected and breakdown by industrial sector and region, substances tested for, etc.).
    - Section 2 summarises the results of the initial monitoring action from various angles of analysis: presence of substances in releases, release levels, etc.
    - Section 3 presents detailed analyses of the results for some substances or families of substances.

PART 1: PRESENTATION OF THE STUDY AND METHODOLOGY

1. BACKGROUND AND STUDY OBJECTIVES

1.1 BACKGROUND

The Water Framework Directive (WFD)[8] establishes a framework for a Community water policy. It recalls and reinforces the Community guidelines on the good state of aquatic ecosystems. In particular, Article 16 of this Directive aims at enhanced protection of the aquatic environment through specific measures designed to reduce or phase-out the release of so-called priority substances into water bodies.

To contribute to the achievement of the objectives of the WFD on the French territory (achieving good water status and reducing or even eliminating releases of hazardous substances into aquatic environments), a national action for research and the reduction of releases of hazardous substances into water bodies (RSDE) by classified facilities was launched in 2002 by the Directorate General for Risk Prevention (DGPR) of the Ministry of the Environment. The objective is to identify the industry's contribution to these emissions and, if necessary, to take the necessary management measures. This action is part of a broader policy of protecting aquatic environments that also targets other potential sources of emissions, such as urban, agricultural, etc.

The first phase of this action (called RSDE1) took place from 2003 to 2007. This was a prospective phase carried out on approximately 2,650 industrial facilities which was the subject of an overall assessment that was published in early 2008[9]. On the basis of these initial results, a second phase (called RSDE2) was introduced and formalised by circular in 2009.

The objective of this second phase is to extend it to classified facilities that are subject to authorisation or registration, that have been identified as a concern in terms of aqueous releases. It consisted of the monitoring and quantification of the flow of hazardous substances on lists of targeted substances, defined by industrial sector, in order to precisely characterise and estimate the industrial releases at the national level as best as possible. Consecutively or even jointly with these monitoring actions, actions to reduce these flows have been implemented, based on the results of this monitoring.

The targeted substances are micropollutants, that is to say a set of undesirable substances that are detectable in the environment at a very low concentration (microgram per litre or even nanogram per litre). Their presence is, at least in part, due to human activity (industrial processes, agricultural practices or daily activities) and can, at these very low concentrations, have negative effects on living organisms and humans because of their toxicity, persistence and bioaccumulation. They can be organic or mineral (e.g. metals and metalloids, halogenated volatile organic compounds (HVOCs), polycyclic aromatic hydrocarbons (PAHs), etc.).

This national RSDE action is part of the national action plan against the pollution of aquatic environments (PNAR) published by the order of 30 June 2005, then of the 2010-2013 national action plan against the pollution of aquatic environments by micropollutants of 13 October 2010. The importance of this action is reaffirmed in the framework of the development of the 2015-2021 national micropollutants plan to preserve water quality and biodiversity.

[8] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for a Community action in the field of water policy.

[9] INERIS report, “Hazardous Substances for the Aquatic Environment in Industrial and Urban Releases - Overview of the National Action for Research and the Reduction of Releases of Hazardous Substances into Water Bodies (RSDE) by Classified Facilities and Other Facilities”, Gréaud L., Reference DRC-07-8261513836C, 2008.

INERIS provides technical support to the Ministry of the Environment throughout the entire process: supervision of sampling and analyses, collection and storage and verification of the quality of the initial monitoring data, and finally, exploitation and analysis of these data in order to improve the knowledge of the releases and support the emissions reduction phase.

1.2 STUDY OBJECTIVES

The study carried out by INERIS aims at proposing a national summary of the results of the monitoring carried out as part of the RSDE2 action, on the basis of the analysis of the data collected and made available through the development and maintenance of a dedicated database.

The data exploitation carried out and presented in the context of this report is in line with the operational objectives pursued by the monitoring action, namely:

- improving the knowledge of releases of hazardous substances by the ICPEs on the following aspects:
    - the presence of substances in releases at quantifiable concentrations (given the current state of available techniques);
    - the release levels (in concentrations and flows);
- highlighting flows that are considered significant (that is, flows exceeding the thresholds for long-term monitoring actions or reduction studies), and identifying the substances, the number of sites and the industrial sectors concerned;
- identifying substances of global interest or for which targeted actions could be undertaken and shedding light on the potential reductions of releases of hazardous substances by the ICPEs, with regard to reduction targets set at the national level for all sources of potential emissions.

2. THE NATIONAL RSDE ACTION

2.1 RSDE ACTION OBJECTIVES

The objective of this action is to better understand industrial emissions in order to identify and prioritise reductions where appropriate, or even elimination in emissions to the aquatic environment of certain hazardous substances identified by the Water Framework Directive (WFD)[10] in Appendices VIII and X, and in its national transposition.

This targeted action on classified facilities is part of a more global approach to identify and reduce pressures on the aquatic environment (all sources combined), taking into account the following deadlines:

- **2015** (or even 2021 or 2027 in the event that an exemption is identified in the SDAGE): achievement of the objective of good chemical status and compliance with the principle of non-degradation of surface water bodies, reflected in the positioning of the SDAGE approved at the end of 2009.
- **2021** (or even 2028 for certain substances): compliance with the national objectives of reduction or even elimination, imposed by the WFD, also included in the SDAGE.

To achieve all of these objectives, the RSDE action aimed at prioritising the actions to be undertaken (monitoring and reducing emissions), in the direction of both the main emitters (at national level), as well as in the more sensitive environments (at the local level).

We recall that the existing regulatory tools to control industrial emissions remain applicable, in particular the emission limit values (ELVs) defined in the national regulations governing classified facilities and the emission levels associated with the best available techniques (BAT-AELs) for sites subject to the Industrial Emissions Directive (IED)[11]. ELVs and BAT-AELs already exist for some substances included in the RSDE action. A discussion has been initiated by the Ministry of the Environment concerning the possible revision of the opposable ELVs for classified facilities in light of this action's results. In addition, these are also valued in the framework of preparing reference documents on the best available techniques (BREF) in order to take advantage of the knowledge acquired at European level.

In addition, the implementation of this action also:

- led to improved practices for the collection and analysis of hazardous substances;
- provided a significant and quality contribution to the inventory approach (and related reporting) of the emissions, releases and losses of priority substances to surface water required by the WFD in Article 5;
- contributed, within the scope of the ICPEs, to the national policy for combating the emissions of hazardous substances into water bodies implemented to meet the objectives of the WFD.

2.2 FRAMEWORK OF THE RSDE2 ACTION

The texts governing the implementation of the RSDE2 action at the national level are as follows:

[10] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for a Community action in the field of water policy.

[11] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).

- Circular of 5 January 2009[12];
- Notes of 23 March 2010, 27 April 2011[13] and 19 September 2011[14].

These instructions were declined at the level of each ICPE concerned by a prefectural order issued by the inspection of classified facilities. The authorisations for industrial waste water release from the concerned classified facilities have thus been supplemented with provisions concerning monitoring and reduction of releases of hazardous substances into the aquatic environment.

The implementation of the national RSDE action began with a first phase that monitored the releases from each ICPE, called initial monitoring. Depending on the results of this monitoring, a long-term monitoring phase, or even studies on the reduction of releases, could have been prescribed to these ICPEs by prefectural order according to the significance of the releases compared to national criteria (thresholds defined for in the Note of 27 April 2011) or local criteria (depending on the impact on the body of water).

- **Initial monitoring**: 6-measurement campaign on a monthly time step on a list of substances, determined according to the site's activities (see section 2.3);
- **Long-term monitoring**: maintaining monitoring, with quarterly measurements for substances released in quantities that are deemed significant or that have an impact on the environment (see section 2.4);
- **Reduction studies** describing the possibilities of reducing or even eliminating the flow of hazardous substances that are deemed significant, with a precise schedule for the envisaged reduction measures (see section 2.4).

At the same time, maintaining a substance under long-term monitoring is reflected in the operator's obligation to complete an annual pollutant emission declaration for this substance (provided for by the Ministerial Order of 31 January 2008).

Establishing the long-term monitoring of hazardous substances on a site must also be accompanied by the use of the GIDAF tool (Computerised Data Management for Frequent Self-Monitoring) for the collection of data relating to this site.

2.3 INITIAL MONITORING

2.3.1 FACILITIES AND EFFLUENTS CONCERNED

The Circular of 5 January 2009, Part 1.2.1, provides for the implementation of the RSDE2 action for ICPEs "*subject to authorisation whose releases are released into the natural environment, directly or via a waste water treatment plant (on-site or off-site), [...] having an activity referred to in Appendix 1* (of the same circular - see Part 2.3.2) *and having an industrial waste water release permit"*.

[12] Circular of 5 January 2009 on the implementation of the second phase of the national action for research and the reduction of substances hazardous to the aquatic environment found in releases from facilities classified for environmental protection (ICPEs) subject to authorisation (Ministry of the Environment).

[13] Notes of 23 March 2010 and 27 April 2011: adaptations of the conditions of implementation of the circular of 5 January 2009 relating to research and the reduction of hazardous substances in aqueous releases of classified facilities (Ministry of the Environment).

[14] Note of 19 September 2011: Framework of the technical and economic study planned in the context of the implementation of the second phase of the RSDE (*Recherche de Substances Dangereuses dans l'Eau* - Research on Hazardous Substances in Water) action (Ministry of the Environment).

The Circular, in Part 1.2.2, also targets the effluents concerned by the RSDE2 action, namely "*water from the industrial process and rainwater or cooling water that may be contaminated by the industrial activity (for example landfill leachates or rainwater from outdoor activity areas in contact with industrial facilities). Rainwater from traffic lanes or collected from roofs and surfaces not affected by the industrial activity of the establishment are excluded from this category*. *Landspred raw water*[15] *is also included in this field (of the RSDE2 action)"*.

Finally, the Circular, in Part 1.3, set priorities for recommending initial monitoring, as follows:

- ICPEs falling within the scope of the Industrial Emissions Directive (IED) with a release authorisation for industrial water;
- new ICPEs or those subject to complementary prefectoral orders;
- ICPEs appearing on the list of sites with stakes established at the regional level because of the criteria on the pollution of surface waters and for which industrial water releases are regulated by a prefectural or ministerial order as well as any other site identified at the level local because of its industrial water releases and for which the approach was deemed to be a priority;
- Decommissioned water bodies: in parallel with the priorities defined above, in the event of non-compliance with a quality standard for a substance that may locally result in the decommissioning of a body of water and if the SDAGE's programme of measures provides for the implementation of a generalised action on this watershed to allow the return of this body of water to a good state, all the ICPEs likely to emit the substance or substances concerned via their aqueous releases must be quickly subject to monitoring.

2.3.2 SUBSTANCES TESTED FOR

The targeted substances are micropollutants (such as metals and metalloids, halogenated volatile organic compounds (HVOCs), polycyclic aromatic hydrocarbons (PAHs), etc.).

Appendix 1 lists all the substances tested for and the associated chemical families.

In parallel, the chemical oxygen demand (COD) or the total organic carbon (TOC) and the suspended solids (SS), the "classic" pollution monitoring parameters, must be measured for each of the releases. The objective is to verify the representativity of the company's activity during the sampling, in comparison with the known data on these parameters.

The substances tested for are classified into "categories" according to the stakes in terms of the hazardousness of the substances and the quality objectives of water bodies and the reduction or elimination of the releases of these substances (DCE objectives), as described in Table 1[16].

[15] "Raw water": untreated waste water.

[16] The categories of substances indicated in this report are those indicated in the circular of 5 January 2009. However, these categories have been modified for certain substances by Directive 2013/39/EU, amending the Water Framework Directive 2000/60/EC (for example, some substances previously classified as "priority" are now classified as "priority hazardous substances", such as the following brominated diphenyl ethers: BDE 47, BDE 153, BDE 154).

Table 1: Categories of substances tested for

Concern	Category of substances	Substances concerned	Challenge for assessing the status of water bodies
Substances of European interest	**Priority hazardous substances**	From **Appendix X of the WFD** [17] and from Directive 2008/105/EC [18] amending the WFD	Chemical state
	Other priority hazardous substances[19]	From **List I of Directive 2006/11/EC** [20] (formerly Directive 76/464/EEC) and not listed in Appendix X of the WFD	
	Priority substances	From **Appendix X of the WFD**	
Substances of national interest	**Specific Pollutants of the Ecological Status**	Only some of these pollutants From the order of 25 January 2010 [21]	Ecological Status
	Other relevant substances	Other substances falling under the National Action Plan against the Pollution of Aquatic Environments (PNAR) (Order of 30 June 2005[22])	Compliance with national EQSs
	Other RSDE substances	Other substances measured in the context of the RSDE operation since 2009	-

Priority hazardous substances, priority substances and pollutants specific to the ecological state are listed in the amended order of 25 January 2010.

Additional substances identified in the National Action Plan against Pollution of Aquatic Environments (PNAR), also taken into account in the framework of the RSDE action, are listed within the Order of 30 June 2005.

[17]EU Water Framework Directive (WFD): Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for a Community action in the field of water policy.

[18] Directive 2008/105/EC of the European Parliament and of the Council establishing environmental quality standards in the field of water, amending and repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC.

[19] These substances are grouped with priority hazardous substances (they are subject to the same objectives of eliminating emissions and they also qualify the chemical status of water bodies).

[20] European Directive No. 2006-11 of 15 February 2006 of the European Parliament and of the Council on pollution caused by certain hazardous substances released into the aquatic environment of the Community (codified version).

[21] Order of 25 January 2010 on the methods and criteria for assessing the ecological status, the chemical status and the ecological potential of surface water under Article R. 212-10, R. 212-11 and R. 212-18 of the Environmental Code.

[22] Order of 30 June 2005 on the National Action Programme against the Pollution of Aquatic Environments by Certain Hazardous Substances.

The objectives of reducing or eliminating releases of these substances have been defined, in application of the WFD, in the circular of 7 May 2007. These were updated for the second WFD cycle in the technical note of 11 June 2015[23].

For the report as a whole, substances are presented according to the colour code used in the table above, relating to the category of the substance.

Rules for counting the number of substances and assigning them to the different categories have been defined. They may vary according to the objective pursued. The rules are as follows:

- the criteria for triggering long-term monitoring actions or reduction studies concern, in certain cases, groups of substances (nonylphenol ethoxylates, octylphenol ethoxylates, brominated diphenyl ethers, PCBs, hexachlorocyclohexanes). When working on this type of indicator in this report (see section 2.3), the groups of substances in question are counted, but not the individual substances concerned. The total number of groups of substances to be considered is 98 (including 21 priority hazardous substances, 24 priority substances, 4 specific pollutant of the ecological statuss and 49 relevant substances);
- on the other hand, when working on indicators relating to each substance (for example the quantificaation frequency - see section 2.1), substances are accounted for individually. The total number of substances to be considered is 112 (including 25 priority hazardous substances, 28 priority substances, 4 specific pollutant of the ecological statuss and 55 relevant substances);
- nonylphenol ethoxylates are counted as priority hazardous substances and octylphenol ethoxylates as priority substances (same categories as nonylphenols and octylphenols respectively).

As regards the alkylphenol ethoxylates, please note the following elements:

Only alkylphenols are covered by the WFD. However, alkylphenols only have a few major direct applications in industrial or detergent formulation. They are intermediates in the manufacture of surfactants, phenolic resins, etc. Most of the alkylphenols are used to produce ethoxylates, which are then incorporated into formulations. In addition, alkylphenol ethoxylates are not stable in the environment and rapidly deteriorate into alkylphenols. They are therefore ultimately a source of alkylphenols in the environment. For these reasons, it was considered relevant to conduct research into aqueous releases from facilities classified for both alkylphenols and ethoxylates. The presence of the ethoxylates can be demonstrated in an indicative manner by the test for the first two homologues of ethoxylates, that is to say, the mono-ethoxylated and di-ethoxylated compounds, denoted as NP1EO, NP2EO, OP1EO and OP2EO[24]. These alkylphenol ethoxylates, although not covered by the WFD, have therefore been included in the lists of substances to be tested for.

[23] Technical note of 11 June 2015 on the national objectives for the reduction of emissions, releases and losses of hazardous substances in surface water and their implementation in the 2016 - 2021 SDAGE.

[24] INERIS note INERIS-DRC-08-94591-06911C describes these elements in detail.

2.3.3 SECTOR-SPECIFIC LISTS

The lists of substances to be tested for were defined according to the industrial sectors in Appendix 1 of the circular of 5 January 2009[25]. These sector-specific lists were developed on the basis of the results of the first phase of the RSDE action, for which 106 substances were systematically tested for at the 2,650 sites. Shortlists of substances could then have been established for 41 sectors or sub-sectors in collaboration with the relevant professional representatives.

The list of hazardous substances to be monitored for a given ICPE must be drawn from these sector-specific lists and from the elements provided by the operator to the classified facilities' inspection[26].

Some or all hazardous substances have been dealt with outside the sector-specific lists (see the circular of 5 January 2009, part 3, concerning DEHP, 5 hazardous priority PAHs, chloroalkanes and PCBs):

- DEHP:

"*Not dealt with by the initial monitoring in the releases but by an action upstream on the identification of the sources of this pollutant*". In the event of decommissioning or risk of decommissioning of water bodies, the monitoring of DEHP may be imposed on sites where long-term monitoring has been implemented on another substance (see the Note of 27 April 2011, part 2.2.3).

- 5 Hazardous priority PAHs[27]:

"*Present in a large number of industrial releases measured in the framework of RSDE1 but where industrial activity is probably not the majority source compared to other types of sources and in particular atmospheric emissions linked to combustion and road transport. However, the emissions of these 5 substances by certain industrial sectors using products containing them deserve to be quantified in a more precise way*". They have therefore been included in certain sector-specific lists.

- C_{10}-C_{13}-chloroalkanes:

"*Absence of a standard method for the analysis of chloroalkanes in water bodies*. *Nevertheless, chloroalkanes, or chlorinated paraffins, can still be used in France in metal machining as a cutting oil, as a plasticiser and flame retardant in paints, coatings and rubber, as a dipping solution in the leather industry, in mastics, and as an impregnating agent in the textile industry*. *It is therefore requested, for sites in these sectors that could not have justified the impossibility of C_{10}-C_{13}-chloroalkanes releases, to qualitatively evaluate these emissions (for example through material balance*)".

The results presented in this paper on C_{10}-C_{13} chloroalkanes are therefore to be taken with caution and are only qualitative assessments of releases (these results are taken into account and presented in Appendices only).

- PCB:

[25] Circular of 5 January 2009, Appendix 1: Lists by sector of industrial activity of potentially hazardous substances in the aqueous releases of establishments carrying out this industrial activity.

[26] The substances tested for by the ICPEs in the same industrial sector may vary according to the elements provided by the operators, as well as local conditions (substances may have been be added or deleted in relation to the sector-specific lists in the prefectural order of a given ICPE).

[27] Benzo(a)pyrene, benzo(k)fluoranthene, benzo(b)fluoranthene, benzo(g, h, i)perylene, indeno(1,2,3-cd)pyrene.

- *"[...] PCBs are not [...] in bold in any sector-specific list. Other actions of the inspection carried out concomitantly aim at making sure the regulation relative to the elimination of equipment containing PCB is respected"*.

2.3.4 TECHNICAL REQUIREMENTS FOR SAMPLING AND ANALYSIS OPERATIONS

The sampling and analysis of hazardous substances in water must be carried out in accordance with the technical requirements specified in Appendix 5 to the circular of 5 January 2009[28]. These requirements were drafted with the collaboration of INERIS, member of the National Reference Laboratory for Aquatic Environment Monitoring (AQUAREF)[29], whose mission is to disseminate guides/ good practices for the sampling and analysis of micropollutants.

In particular, the quantification limits to be met when analysing each of the hazardous substances are defined in Appendix 5.2.

Sampling can be done by the operators themselves or by service providers. On the other hand, the analyses must be carried out by laboratories accredited according to standard NF EN ISO/IEC 17025 for the "effluent water" matrix.

The results must then come back, in an initial monitoring report for the inspection of classified facilities on the one hand, and by entering the results via an online input tool to then be stored in a database managed by INERIS on the other (see section 3.1).

2.4 LONG-TERM MONITORING AND REDUCTION STUDIES

The note of 27 April 2011 specified the conditions for the implementation of the RSDE action, the subsequent steps and the follow-up to be given to the initial monitoring stage.

The substances are to be classified into 3 categories:

- *"Substances analysed during initial monitoring for which it is not useful to maintain monitoring given the low levels of releases observed: substances to be abandoned;*
- *Substances whose quantities are significant enough for the long-term monitoring of these emissions to be maintained: substances to be monitored;*
- *Among these substances to be monitored, those for which the quantities released are not low enough to exempt operators from an in-depth analysis on the means at their disposal that can lead to reductions or even eliminations: substances which, in addition to monitoring, are the subject of an action programme."*

The criteria for achieving this classification are detailed below (in part 2 of the Note).

In particular, the first criterion consists of the **comparison of the flow levels with average daily flow thresholds for each substance**, defined in Appendix 2 of the Note of 27 April 2011[30]. Exceeding a first level of daily flow threshold ("Column A" thresholds) implies maintaining long-term monitoring on the substances and exceeding a second level of daily flow threshold ("Column B" thresholds) implies the need for reduction studies (see section 2.1.1 and part 2.2.2 of the Note).

The note states that "setting such flow criteria meets the need to prioritise the actions to be undertaken towards the most contributing ICPEs". This criterion is applicable to connected and unconnected releases.

[28] Circular of 5 January 2009, Appendix 5: Technical requirements applicable to sampling and analysis operations.

[29] The 5 public institutions members of AQUAREF are: BRGM, IFREMER, IRSTEA, LNE and INERIS.

[30] The set of daily flow threshold values defined in Appendix 2 of the Note of 27 April 2011 is given in Appendix 1 listing the substances in the RSDE2 action.

It can also be noted that these flow thresholds have been set taking into account the categories of substances tested for. In fact, the higher the "hazardousness" of the substances (priority hazardous substances, then priority substances, etc.), the lower the thresholds have been set[31].

Other criteria are also defined[32] in the note of 27 April 2011, including:

- the "consideration of the environment" for direct releases to the natural environment for maintaining long-term monitoring on the substances of which quantity has caused a local impact (part 2.1.2) as well as their addition to a reduction study (part 2.2.2);
- maintaining monitoring for substances for which measurements have been qualified as unacceptable (parts 2.1.0 and 1.1);
- for the special cases of effluent landspreading: a reduced device compared to the application of the comparison criterion to the trigger threshold flow of reduction studies (criterion in column B) can be set up depending on piezometric monitoring of the relevant groundwater body (part 2.2.4).

Thus, the objective is to target reduction efforts on the main national industrial contributors (contribution to the national reduction objectives resulting from the implementation of the WFD) and towards the environments most directly affected by the ICPEs' releases (contribution to the objectives of good status of water bodies).

Finally, the approach and the expected content for the reduction studies (action programmes and/or technical economic studies) are also defined in the notes of 27 April 2011 and 19 September 2011.

[31] The Note of 27 April 2011, part 2.2.2., states that "the threshold values were determined from the knowledge of [...] releases (at the time of writing) and the toxicity values specific to each substance".

[32] These criteria have not been taken into account in this report (especially in section 2.3).

3. COMPARABILITY - RELIABILITY OF RESULTS

Feedback from the first phase of the RSDE action has led to improvements in the second phase of this RSDE action concerning the quality of the data collected.

A precise framework for the action upstream of its launch, via Appendix 5 of the circular of 5 January 2009[33], as well as a certain number of controls carried out in the course of action and before exploitation of the results, has improved the reliability of the data. These elements were mainly focused on the following aspects (some of them being more detailed in the following sections):

- **Representativeness**:
    - Six measurement campaigns for the RSDE2 initial monitoring instead of one for RSDE1, in order to take into account the temporal variability of the releases of a site and to ensure a better representation of the latter;
    - The RSDE2 action, governed by regulations, concerned more sites (around 4,800 industrial sites[34]) than the RSDE1 action conducted on a voluntary basis (around 2,650 industrial sites), thus enabling more data to be acquired by industrial activity;
- **Metrological framework for sampling and field analysis**, according to the technical specifications specified in Appendix 5 of the circular of 5 January 2009 (see section 2.3.4). In particular, the quantification limits to be met by the analytical laboratories have been defined for each substance[35];
- **Framework for the collection and storage of data** (see section 3.1);
- **Qualification of the data entered in the database**: checking compliance with technical requirements for the sampling and analysis operations (see section 3.2).
- **Verification/ correction** of the data entered in the database before being used to compile the summary of results in this report (see section 3.4).

3.1 CREATION AND QUALITY MONITORING OF THE RSDE DATABASE

In order to carry out the collection and storage of data from the initial monitoring of the RSDE2 action, INERIS set up a dedicated information system consisting of a database and an online collection application. The results are entered via the website whose access is nominative and secure for manufacturers (validation of registrations that have been checked for consistency).

The general principle is described below.

The website allows Classified Facilities' operators to enter their initial monitoring analysis results: description of each sampling point, specimens, samples, and details of the analyses for each measured substance.

[33] Circular of 5 January 2009, Appendix 5, "Technical requirements applicable to sampling and analysis operations".

[34] Source: Ministry of the Environment, Energy and the Sea, on the basis of the indicators reported by the inspection of the classified facilities in the management software of classified facilities S3IC in October 2015.

[35] The quantification limits that were defined corresponded to the value that 50% of the laboratories were most frequently able to reach at the end of the RSDE1 action.

In order to exploit the information collected, the application allows a “directed” input by asking users to choose between defined values rather than filling in free areas. These numerous drop-down lists are most of the time issued from official nomenclatures, and in particular those from SANDRE[36] (such as list of parameters, fractions covered by the analyses, methods, comment codes or units of measurement). The Internet application has been designed so that it can perform several consistency checks while the data is being entered, making the statements consistent and comprehensive.

In the same idea, but also to simplify the data input, the user can directly download a file in EDILABO format. This XML file prescribed by SANDRE allows a well-defined data input, some of which have been made mandatory for the exploitation of data[37]. Once downloaded and to ensure its validity, the file is automatically subject to SANDRE checks, which also provides a certificate attesting compliance to the rules. This way of entering information has been used by more than 85% of sites, which demonstrates its interest among users.

3.2 VERIFICATION OF COMPLIANCE WITH TECHNICAL REQUIREMENTS FOR SAMPLING AND ANALYSIS OPERATIONS

All the data entered, as well as the context of the analytical measurement, were checked along the way. Thus, each data entered in the database has the initial status of unqualified raw data. They were then qualified by automatic control based on quality criteria based on the requirements imposed in Appendix 5 of the circular of 5 January 2009. The data were **qualified** according to three categories:

- “**correct**”: compliant and usable;
- “**uncertain**”: non-compliant but with little impact on analytical results, usable data;
- “**incorrect**”: non-compliant with a strong impact on the result.

This first qualification is called level 1. The data were then submitted to an expert opinion (level 2 qualification) to confirm or refute this classification. At the end of this step, the data status is either level 2 “correct” or “uncertain”, or “incorrect” raw data to be corrected. Level 2 status is the final qualification level of the data. The details of the data control circuit are presented in Figure 1 below.

[36] SANDRE: Service d’Administration National des Données et Référentiels sur l’Eau / National Administration Service for Data and Standards on Water

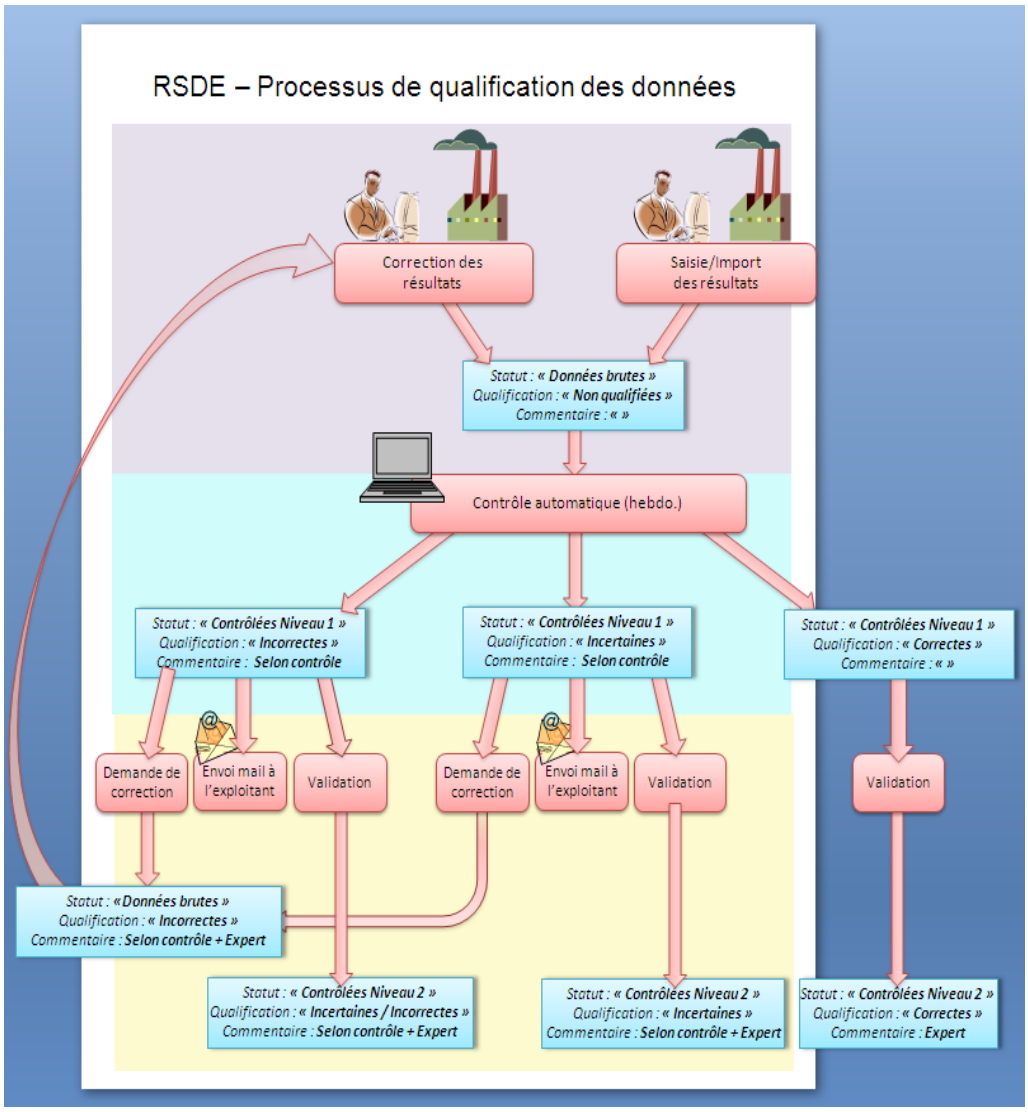


Figure 1: Data qualification process

Table 2 specifies the main non-compliant quality criteria that lead the data to be qualified as "uncertain" or "incorrect".

Table 2: Main uncertainties and inaccuracies identified when qualifying data

Main errors found	Associated qualification
During the transport of the samples: unmet delivery time to the laboratory after sampling.	uncertain
Failure to meet the deadline for beginning the analytical process < 15 days.	uncertain
Failure to meet the deadline for beginning the analytical process ≥ 15 days.	incorrect
The analysis was not performed under accreditation.	incorrect
For releases ≥ 250 mg/l, the parameter was not rendered in the 3 phases: raw water, filtered water, particulate phase.	incorrect
For releases ≥ 250 mg/l, $QL_{lab} > QL_{imposed}$ and no exemption for exceeding the QL was requested.	incorrect then uncertain since 03/2015
For releases < 250 mg/l, $QL_{lab} > QL_{imposed}$ and no exemption for exceeding the QL was requested.	incorrect

The automatic controls and expert opinions implemented have made it possible to change the percentage of correct data to level 2. Thus, during the first validation of data, the percentage of correct base data was 6.5% in June 2010, which increased to 95% from July 2011. The implementation of these control procedures, based on explicitly defined criteria, made it possible to consolidate this database for it exploitation. Only the correct and uncertain data from level 2 were selected for this study.

3.3 FEEDBACK FROM METROLOGICAL CONTROLS

The results presented should be interpreted taking into account the uncertainties associated with determining flow rates and concentrations. These two variables are included in the calculation of the emitted flows.

Uncertainty means sources of error, bias or possible approximations. This is not an estimate of uncertainties in the statistical sense of the term.

The circular of 5 January 2009 defined a specific framework for measuring flows and carrying out sampling and analysis operations in order to better guarantee the quality of the data produced and to limit disparities between the practices of service providers to ensure the comparability of results.

In addition to these technical requirements, Frequently Asked Questions (FAQs) on the INERIS RSDE website have been made available to the sampling organisations and laboratories in order to provide useful details for sampling and analysis.

Therefore the reliability of the data set used in the report depends on the respect of these requirements and the precautions that have been taken during sampling and analysis operations.

3.3.1 UNCERTAINTIES RELATED TO SAMPLING OPERATIONS

Taking samples to analyse micropollutants requires more precautions than "conventional" self-monitoring parameters (index or general parameters) implemented by manufacturers. In addition, although the circular of 5 January 2009 defines requirements on sampling operations, it does not require the use of accredited sampling organisations, a condition that provides a quality guarantee of the additional data produced.

Thus, the sampling process was examined at each stage and the various parameters that could impact the representativity of the results were discussed, as follows:

- the experience of the samplers;
- types of sampling (choice of materials used in sampling systems and sampling conditions);
- management of sample contamination phenomena;
- homogenisation of the collected volume;
- storage conditions during transport.

3.3.1.1 THE SAMPLERS' EXPERIENCE

As part of the initial monitoring, the samples were taken by the operators themselves for 87 sites, representing 2.3% of the total sites. Appendix 5 of the circular of 5 January 2009 left this possibility (see section 3.1 of this circular) to the extent that he must prove "[...] that he has procedures demonstrating the reliability and reproducibility of its sampling and flow measurement practices". These procedures must incorporate the prerequisites set out in this Appendix, relating to the general conditions for sampling, the measurement of the flow rate, the type of sampling, the storage of the samples and the sampling blanks; and must demonstrate that the traceability of these operations is ensured. Under these conditions, and subject to compliance with the requirements of the circular, it appears that the required precautions have been taken to limit uncertainties related to the samples.

For all the other sites, the investigations were carried out by independent sampling organisations, subject to the same requirements as the operators.

3.3.1.2 TYPES OF SAMPLING

The **choice of sampling devices and sampling conditions** (sampling dependent on the site's release rate, the time or one-time testing only) can have an influence on the result.

As regards the choice of sampling devices, the risk was limited because recommendations made by AQUAREF were issued as soon as the action was launched (on the INERIS RSDE website): Teflon sampling line, glass collection bottle, silicone crush hose when using a peristaltic pump, etc...

As regards the sampling conditions, it is stipulated in Appendix 5 of the circular of 5 January 2009 that the sampling must be **dependent on the site's release rate** and must be carried during a period representative of the normal activity of the site (24 hours in general), in order to optimise the representativeness of the sample taken. This type of sampling was carried out for **76% of the releases taken**.

However these conditions are not applicable in all situations. Thus, **14% of the samples** were made over **24 hours and were time-dependent**, in accordance with the alternatives proposed in the circular. This type of sampling is chosen when the flow is not large enough or when it is not possible to install a flow meter in the effluent outlet channel.

In 10% of cases, only a **one-off** sampling could be implemented. This solution is authorised if the nature of the effluents justifies it. It concerns, for example, effluents samplings stored or in a lagoon, for which the daily flow of the effluents could only be estimated implying a more limited representativity of the sample.

3.3.1.3 MANAGEMENT OF SAMPLE CONTAMINATION PHENOMENA

Contamination of the sample taken, due to pollution residue from a previous campaign or interactions with materials from the sampling and specimen storage system is a factor to be considered. In addition to the cleaning and contamination prevention procedures, blanks are the only controls to ensure that the sample is not contaminated. For this reason, the circular of 5 January 2009 strongly recommends that operators make a sampling system blank in order to verify the absence of contamination related to the materials used (flasks, pipes) or cross-contamination between successive samples. This must be done for a period of 3 hours at least. It can be done in laboratory by circulating micropollutant-free water in the sampling system. It is up to the sampler to implement the provisions to demonstrate the absence of contamination as the transmission of the results acts as their validation. The operator will therefore be considered as the emitter of all the substances found in the releases, at the corresponding contents. It is the operator's responsibility to inspect this absence of contamination.

The **main contaminations observed** in AQUAREF studies or known in the field of sampling are related to the following parameters:

- **metals**, with copper and zinc among the most sensitive, plastic material components like polyvinyl chloride (PVC) that can be used in sampling devices;
- **volatile organic compounds (VOCs);**
- **phthalates;**
- **alkylphenols;**
- **polycyclic aromatic hydrocarbons (PAHs)** (when very low concentrations are tested for).

Quality control of the sampling system (blanks) was carried out for 30% of the operations. The concentrations observed in these cases cannot be overestimated. On the other hand, for the remaining 70%, it is impossible to fully assess any contamination, which could lead to an overestimation of the associated results.

3.3.1.4 HOMOGENISATION OF THE COLLECTED VOLUME

Appendix 5 of the circular of 5 January 2009 indicates that a system for homogenising the volume collected must be systematically implemented in order to obtain homogeneous sub-samples for the different types of analyses carried out. Indeed, as the samples are taken over 24 hours, phase decantation or sedimentation phenomena of suspended solids (SS) are possible which may lead to an underestimation or overestimation of the substances tested for.

However, the circular does not impose a specific homogenisation method. The work carried out in the framework of AQUAREF [38] (2011) has highlighted that the different methods of homogenisation are not all equally effective. Thus, in the course of action, it has been recommended to resort to mechanical homogenisation using a blade that meets specific criteria. As a result, data collected prior to this recommendation may, for some samples, be associated with larger uncertainties.

When releases are full of suspended solids, this issue is even more sensitive as the amount is significant due to an increase of sedimentation phenomena. Over the whole action, **19% of the releases have a significant level of SS** (≥ 250 mg/l), for which the **quantification of the hydrophobic substances** (for example metals, some PAHs, PCBs, etc.) **could have been affected by a lack of homogenisation**.

37 industrial sectors are affected by effluents with a SS content greater than 250 mg/l, including 8 sectors where SS content represent at least 30% of the releases: slaughterhouses (54%); plum drying plants (50%); the agri-food industry (products of animal origin) (45%); hides and

[38] AQUAREF operational technical guide: "Sampling and storage practices for testing for priority and emerging micropollutants in collective and industrial sanitation", first version, Eymery F., Choubert JM., 2011.

skins processing industry (37%); non-chemical pulp preparation (36%); the agri-food industry (products of plant origin) excluding wine production (33%); manufacture of glues and adhesives (30%); wine production (30%).

3.3.1.5 STORAGE CONDITIONS DURING TRANSPORT

Poor storage conditions between the sampling operation and the arrival at the laboratory are also factors to be considered. These are related to:

- the time required to transport samples between the end of the sampling and the arrival at the laboratory;
- the refrigeration temperature of the sampling and transport chambers until receipt at the laboratory.

Sampling organisations complied **97%** of the time with the **maximum 48-hour period** between the start of sampling and the receipt at the laboratory required by the circular. In 3% of cases, this period is greater. For these releases, an absence of substances or an underestimation of some substances is possible as the samples may have changed during the transport to the laboratory (degradation and loss of substances due to bacterial activity, warming of the sample).

With respect to the temperature data upon receipt of samples, **90.5% of the samples** were received at < 8°C, in accordance with the requirements of Appendix 5 of the circular of 5 January 2009. For the remaining 9.5% cases, the non-compliance of the temperature indicates a malfunction of the refrigeration system in the sampling system or the use of inappropriate transport chambers (insufficient number of ice packs or chamber casing not hermetic enough for external temperatures).

Samples can come from effluents rich in bacterial activity or suspended substances. In these cases non-compliance of 24- to 48-hours for the delivery of samples to the laboratory or the non-compliance of 5 ± 3°C can have consequences on the analytical result.

3.3.2 UNCERTAINTIES RELATED TO THE ANALYSES

The technical requirements to be met for the analysis are detailed in section 4 of Appendix 5 of the circular of 5 January 2009. Unlike sampling, it specifies that **the analysis providers must be accredited according to the NF EN ISO/IEC 17025 standard for the "waste water" matrix**, for a defined list of analytes. These selection criteria make it possible to provide guarantees regarding the quality of the results produced. A total of 184 providers carried out analysis operations at the national level.

Despite this established metrological framework, some points of vigilance still deserve to be mentioned, along with the interpretation of the results, as technical difficulties still need to be resolved.

3.3.2.1 CASES OF COMPLEX MATRICES

Releases full of suspended solids (SS) and/or containing interferences, fats (formation of emulsions), etc., are considered as complex matrices.

As regards the matrices only full of SS, in addition to the recommendations relating to the collection of these releases, for the analysis stage, the circular requires dissolved and particulate phases to be separated for samples intended for the analysis of organic hydrophobic substances, when SS content is greater than 250 mg/l. On the opposite case, previous studies have shown that the extraction yields of the organic hydrophobic substances to be analysed are insufficient. All the results presented in this report are based on data that comply with this requirement. However it should be highlighted that this threshold of 250 mg/l is the subject of many technical discussions, in order to know if it should be lowered (it has already been halved between RSDE1 and this RSDE2 action).

On the other hand, if the releases contain interferents and/or alone emulsions associated or not with a high content of SS, the analysis laboratories regularly encounter problems in the pretreatment of the sample. It is for example the case of fats forming emulsions during analysis (slaughterhouse and agri-food sectors, etc.), interferents such as inks (tanneries sector), etc. which disrupt the extraction of micropollutants. The percentage of releases corresponding is not quantifiable in view of the information entered in the database.

3.3.2.2 ANALYTICAL PERFORMANCE AND DEROGATIONS

In order to assess the ability of laboratories to quantify a substance, requirements for the quantification limits (QLs) to be achieved have been set in Appendix 5 of the circular of 5 January 2009. According to the NF T 90-210 standard, the QL corresponds to the smallest magnitude of an analyte to be examined in a sample that can be quantitatively determined under experimental conditions described in the method with a defined accuracy. In other words, it is the value below which it is difficult to quantify a substance with acceptable uncertainty.

When the imposed QL is not respected for a substance, an exemption request justifying this discrepancy must be made to INERIS (here we shall speak of “exempted substances”). Non-compliance with a quantification limit may be related to:

- contamination that may have occurred during the analysis process;
- an effect of the sampled matrix;
- analytical problems (sensitive steps of the method).

At the outcome level, **the non-compliance of QLs during the exploitation of data may imply**:

- **an underestimation of the quantification frequency**;
- **an overestimatation of the release flows, which will be proportional to the delta between the QL actually reached and the imposed QL.** Indeed, if there is a result < QL, the calculation of the potentially released flow is made from the QL/2 value (see section 5).

To list the most exempted substances, the ratio between the number of times the QL was exceeded for the substance over the number of analyses performed was calculated (and is reported in parentheses in % below). Thus, among the “correct” or “uncertain” level 2 stored data, the most exempted substances are:

p-octylphenols (mixture) (31%) and **linear or branched nonylphenols** (16%). For all others substances, this ratio is less than or equal to 5%, which implies one-off analytical difficulties and a limited impact on the results.

As regards nonylphenols and octylphenols (chemical family of **alkylphenols**), which are also part of the most quantified substances, several aspects must be taken into account and are detailed in the following paragraphs.

In direct relation to the non-compliance of QLs observed, analytical blank problems are frequently encountered because alkylphenols are present in many materials used in the laboratories. However, it should be noted that in 90% of cases, the QL achieved by laboratories for alkylphenols is at most 2 times higher than the imposed QL, implying a minor impact on the results.

The quantification of nonylphenols can also be difficult because it is a mixture of isomers that is analysed (which is not the case of octylphenols) and it elutes in the form of isomer pairs in chromatography. Thus, there is a risk of integrating certain interferents at the same time as the desired compounds, hence possible overdoses.

Moreover, other analytical difficulties, aside from the requirements on the QL, have to be noted. First of all, identity errors of the standard to be used for the quantification of nonylphenols are possible. But beyond that, differences between the purity displayed in the standards sold and the actual purity of the standards are also possible (10 to 15% effective impurity, on the basis of the available data), which can in this case lead to an under-estimation of concentrations[39].

Finally, inconsistencies in the SANDRE codification may have distorted the results for nonylphenols and octylphenols. Indeed, initially only nonylphenols with linear chains (SANDRE code 1957) and octylphenols with linear chains (SANDRE code 1920) had to be tested for. However, these forms of alkylphenols were not relevant as it is biodegradable in the environment and is not representative of industrial alkylphenols. Thus, during the action (June 2010), two new substances : nonylphenols with branched chains (SANDRE code 1958) and octylphenols with branched chains (SANDRE code 1959), more relevant for the problem, were included in the initial list. The official integration of these substances into the new complementary prefectural orders has been achieved rapidly, but taking these new substances into account has been slower in the measurement campaigns that have already been undertaken.

The restitution was made under SANDRE code 6598 (code combining SANDRE codes 1957 and 1958) for nonylphenols and under SANDRE code 6660 (code combining SANDRE codes 1920 and 1959) for octylphenols[40]. These elements are summarised in the table below:

SANDRE Code/ CAS No.	Parameter name (in database)
1957 / 25154-52-3	nonylphenols: **linear**-chain **isomer mixture** of all positions
1958 / 84852-15-3	4-nonylphenols: **mixture of branched**-chain **isomers** in para position
6598 = 1957 + 1958	**linear or branched nonylphenols:** mixture of isomers
1920 / 1806-26-4	4-n-octylphenol: **linear isomer** in para position (p)
1959 / 140-66-9	4-ter-octylphenol: **branched isomer** in para position (p)
6600 = 1920 + 1959	**p-octylphenols (mixture):** linear or branched

All the results presented in this report only relate to the parameters returned under the total SANDRE codes: 6598 - linear or branched nonylphenols and 6660 - linear or branched p-octylphenols. These parameters are simply described as "nonylphenols" and "octylphenols" or "p-octylphenols (mixture)" later in this report.

[39] Report "Considerations on certain metrological aspects related to the measurement of 4-nonylphenol - State of the art, assessment of the purity of the standards, the accuracy of measurement and the perspectives on their measurement", Chatellier C., Lestremau F., INERIS reference - DRC-15-136908-00571C, ONEMA – AQUAREF partnership, 2014.

A note is being written (publication in the second half of 2016) to complete the overview of the difficulties related to analysing nonylphenols.

[40] Extract from the FAQ of INERIS' RSDE website.

Thus, these results may have been underestimated at the beginning of the action, before the introduction of branched forms. Besides, for nonylphenols the results (SANDRE 6598) may have been overestimated following the action because results in the 1957 form can actually correspond to the 1958 form. In that case, code 6598 corresponds to 2 times the relevant form (1958) to be tested for, implying much higher concentration levels than reality since the 1957 form is a priori not present in the environment. On the other hand, it is not possible, in the current state of the data exploitation, to estimate on which proportion of the data this imputation error may have been made.

3.3.3 UNCERTAINTIES RELATED TO THE MEASUREMENT OF THE RELEASE RATE

In addition to the uncertainties associated with determining substance concentrations, measuring the release rate is essential to calculate the flow of each substance released. An error during this measurement can lead to a biased flow value. To limit this risk, Appendix 5 of the circular of 5 January 2009 requires operators to ensure the operational quality of the measuring system. For this, periodic metrological controls of the system must be performed before the start of the first measurement campaign, or on the occasion of the first measurement, before being renewed annually. The further away the controls are from the time of collection, the higher the risks are.

The data analysis shows that more than **81%** of the measurement system controls were performed less than one year before the first sampling date. In 1.2% of the cases, these controls were carried out more than five years before the date of the first sampling.

3.3.4 CONCLUSIONS ON METROLOGICAL ASPECTS

The whole metrological analysis shows that several aspects of the sampling and analysis processes can impact the measured concentrations: skills of the samplers, type of sampling (sampling dependent on the release rate of the site over 24 hours), absence of sampling blanks to protect against contamination related to the sampling devices, homogenisation of the collection volume, compliance with transport instructions and routing of the samples, performance on the quantification limits.

The control of the measurement of the release flow, which directly impacts the flow calculation is also added.

The appendix 5 of the circular of 5 January 2009, the technical notes and FAQs provided gave a specific framework and specific recommendations to minimise these uncertainties. Conducting 6 measurement campaigns as part of the initial monitoring also supports the conclusions about whether or not a substance is present in the releases of a site, thanks to an improved representativeness of the results compared to RSDE1.

Despite all these precautions, data on **alkylphenols** and **complex matrices** must be **interpreted with caution**, with some metrological aspects that still need to be improved or better controlled.

3.4 ADDITIONAL CHECKS/ CORRECTIONS OF THE COLLECTED AND STORED DATA

Prior to using the data to compile the summary of the results in this report, the data entered in database was verified and corrected. Indeed, a number of potential data entry errors were identified and the need to exclude some of them became apparent.

The process of verifying the entered data was designed in the same way as for metrological quality controls:

- an automatic data control was set up,
- followed by validation, correction if possible or manual exclusion of the data by “expert opinion”. This step was carried out by the inspection of classified facilities or by INERIS when this was not possible.

The verifications focused on release rates, the sites with multiple collection points, the sites with the highest flows, and the industrial sectors associated to the sites. These verifications are detailed in the following paragraphs.

- Flow rates:
  - verification of high flow rates (flows greater than 2000 m^3/d);
  - exclusion of samples with a flow rate entered equal to zero (flows equal to 0 m^3/d);
  - verification of flow rates when large deviations are detected between the different flow values entered during all measurement campaigns (deviation greater than 10 between the maximum and minimum flow values);
  - erroneous flow rates have been corrected when it was possible. Otherwise, all associated results were excluded from the data set[41].

- Sites with multiple sampling points:

Some sites carried out measurement campaigns at several sampling points. For some sites, there are several points of release (some chemical sites for example). However, in other cases, the sites may involve effluents different from industrial effluent releases (such as rainwater, effluents of cooling towers, etc.) or sampling points within the site (in order to determine the origin of certain substances for example).

- verification of sampling points for sites that entered more than 5 sampling points: exclusion of points if it is possible to confirm that it is not a point where industrial effluent releases leave the site (such as a sampling point within the site);
- exclusion of sampling points for other effluents than industrial effluent releases, in particular: upstream water[42], rainwater, effluents from cooling towers, sampling blanks, long-term monitoring data[43], initial monitoring data of urban waste water treatment plants[44] (by searching for keywords in the "sampling point" and "sampling" fields).

After verification and exclusion of this sampling points, it can be seen that about 90% of the sites entered a single sampling point, less than 10% entered 2 sampling points (mainly chemical sites) and only a few sites have more than 2 sampling points.

- Sites with the highest flows:

In addition, before the data was exploited, a verification of the sites with the most significant flows was carried out, in order to identify those with abnormal flows, on the basis of the classified facilities and INERIS' inspection knowledge. In this way, some concentration or flow rate values have been corrected (though to a lesser extent).

- Industrial sectors the sites are associated with:

Some precautions must be taken for the interpretation of the results for the industrial sector each site is associated with. Indeed, the industrial sector as defined in the RSDE operation normally corresponds to the polluting activity that is likely to emit hazardous substances and not necessarily to the main activity of the site. The operators classified each site when they entered the results into the RSDE INERIS database. Compliance with this definition when classifying each site within an industrial sector is difficult to verify.

[41] It should be kept in mind that some of these data excluded from the data set used in this report may relate to sites that emit micropollutant levels above the long-term monitoring or reduction studies thresholds.

[42] Some sites have carried out analyses on upstream waters, i.e. their site's feedwater (see the section on "imported daily flow" below).

[43] Some sites entered by mistake analysis results from their long-term monitoring into the initial monitoring database.

[44] Urban waste water treatment plants entered by mistake analysis results from their RSDE initial monitoring (otherwise managed) into the classified facilities database.

The most likely “activity crossovers” are:

- between metallurgy (14.1 to 14.4), mechanics (20) and surface treatment (21) sectors;
- between “specific” chemical sectors (7 to 11) and the general chemical sector (6).

Verification was conducted by industry sector representatives on sites registered in certain sectors to correct a large portion of the assignment errors.

➢ Imported daily flow:

In cases where the release and the sampling are carried out in the same environment, and if concentration measurements of the substances have been carried out in the environment upstream of the ICPE sampling, the note of 27 April 2011 provides the possibility of subtracting the “imported” flow[45] from the water sampled in the environment from the average daily flow emitted by a site. Calculating this imported daily flow could not be done automatically in the database, the flows concerned were therefore not corrected. Consequently, these possible deductions have not been taken into account in the data used for this study. However, it is taken into account, in the field, by the operators and the inspection of classified facilities for each site concerned.

[45] The exact calculation rule is described in the note of 27 April 2011, part 1.2.3.

3.5 SELECTING STUDY DATA

Only the following data were selected in the data set analysed in this report:

- **data qualified as correct and uncertain** following the verification phase of compliance with the technical requirements for sampling and analysis on the one hand (see section 3.2), and following the verification phase of the data entered, on the other hand (see section 3.4);
- **analysis results for substances in the sector-specific lists only.** On some sites, analyses carried out on substances not included in the sector-specific list of the industrial sector in which they are classified were excluded. Indeed, it has been considered that, although potentially relevant for analysis at some particular sites, these substances may not be representative for the sector as a whole. The analyses carried out on the substances forming part of the sector-specific lists and on those not part of it were thus differentiated. Only the analyses performed on the substances in the lists were used for the results, presented per sector or in a comprehensive manner in this report.

3.5.1 DATA ENTRY PERIOD

The following graph (Figure 2) lists the number of registrations over time since the launch of the RSDE2 data entry site. Although the site was launched in April 2009, only a few registrations were validated before summer 2010. On the other hand, there was a rather abrupt "increase in load" over nine months: from 265 sites registered in July 2010, the site had 1,084 sites registered in March 2011 (+ 300%). A gradual decrease in the number of monthly registrations has since been observed, with in 2015, on average, still about twenty sites making a request to open an account each month.

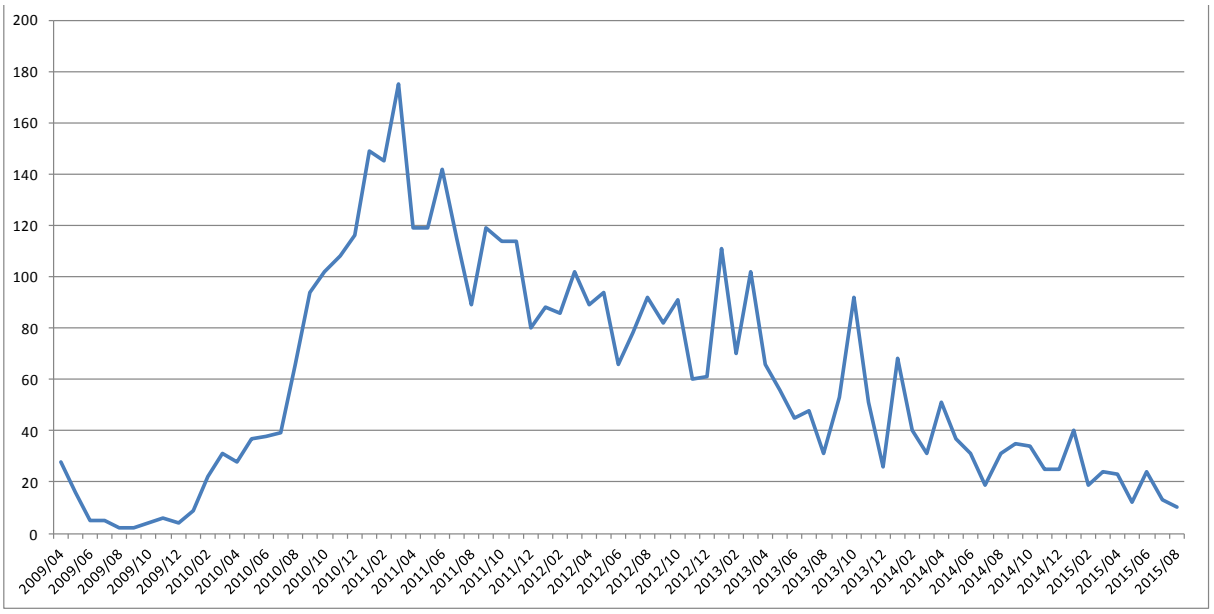


Figure 2: Number of registrations on the RSDE site by month

The data used in this study are those extracted from the RSDE database in August 2014. **Data entered after this date are not included[46].**

About 200 sites have registered on the website since September 2014, about 5% of the total number of sites registered in the database.

3.5.2 DATA USED FOR THE STUDY

Table 2 compares the amount of information entered on the RSDE site and what was selected for this study (after qualification).

Table 2: Data retained for the study

	Data entered on the RSDE site	Data used for the study
Number of sites:	4,240	3,722 (88%)
Number of sampling points:	5,611	4,320 (77%)
Number of analyses:	893,263	644,379 (72%) including 519,332 used [47] (58%)

[46] Indeed, since a data verification/correction phase was necessary before the exploitation, it was decided to work on an extraction of the database at a time t to be able to perform this verification. Subsequent checks in March 2015 of the additional data entered in this period were used to identify the impact that these data could have on the results. There was no evidence that taking into account these additional data could significantly alter the results presented in this report (i.e. the number of long-term monitoring actions or reduction studies would of course be increased (in absolute), but in the same proportions overall as those presented here).

However, it should be noted that sites that submitted data after August 2014 or did not enter their results in the INERIS database may represent significant flows and are not included in the data set used in this report.

[47] Among the analyses available, only the analyses performed in the context of the substances in the sector-specific lists were selected for all the results presented in this report (see section 3.5). Among the approximately 125,000 analyses carried out on non-sector-specific list substances, about 48,000 analyses (38%) concern classical parameters (COD, SS, TOC).

3.5.3 NUMBER OF SAMPLES TAKEN PER SITE

The following table presents the distribution of sites according to the number of samples taken.

Table 3: Number of samples taken per site

Number of samples taken per site	Number of sites	% of sites
1	255	7%
2	110	3%
3	480	13%
4	200	5%
5	275	7%
6	2,330	63%
7	43	1%
8	6	0.16%
9	5	0.13%
10	4	0.11%
11	2	0.05%
12	9	0.24%
13	1	0.03%
15	1	0.03%
16	1	0.03%
Overall Total	3,722	100%

It can be seen that for 35% of the sites, the number of samples taken is less than 6 samples per initial monitoring campaign, as required by the RSDE action circulars. For 2% of the sites, the number of samples is higher: several points per site, upstream waters, etc. (see section 3.4).

3.6 CONCLUSION OF SECTION 3 COMPARABILITY - RELIABILITY OF RESULTS

The overall data qualification and verification work detailed in section 3 has improved the quality of the data entered in the database and selected for the analysis of the results summarised in this report. Although this work restricted the data set, it improved its quality by presenting a more realistic picture of releases.

4. METHODS FOR CALCULATING AND AGGREGATING DATA

Results on the weighted average concentrations by the sites' average daily release rates and flows are presented in part 2. These were calculated according to the calculation methods described in the note of 27 April 2011[48].

It was calculated for each sampling point (or point of release), from the whole concentrations and release rates measured during each sampling and entered into the database.

4.1 CALCULATION OF FLOW-WEIGHTED AVERAGE CONCENTRATION (WAC)

$$WAC = \frac{C1 \times D1 + C2 \times D2 + \ldots + Ci \times Di}{D1 + D2 + \ldots + Di}$$

With:

- WAC: flow-weighted average concentration in µg/l
- Di: Release rate measured during sampling i (i^{th} measurement campaign) in m^3/d
- Ci: Concentration measured during sampling i (i^{th} measurement campaign) in µg/l

For each Ci concentration value:

The note of 27 April 2011 formulates the following rule: *"when the result for some of the concentrations is indicated as being lower than the quantification limit that the laboratory has worked with, the value to be taken into account in the calculation of the average is equal to half of the value of the quantification limit indicated by the laboratory"*. This rule has been taken into account in the applied calculations, and supplemented by others, as described in table 4.

This table indicates the concentration values used for the calculations according to the SANDRE remark codes[49].

Table 4: Concentrations retained for calculations of average concentrations according to remark codes

Remark codes [50]	Retained concentration
1 / Range of validity Result *(i.e. > QL)*	Result entered
2 / < detection threshold	0
3 / > saturation threshold	Result entered [51]
7 / Traces	If Result entered = QL then Result entered / 2; otherwise Result entered
10 / < quantification threshold *(i.e. < QL)*	Result entered / 2 (i.e. QL reached by the laboratory / 2)

[48] Note dated 27 April 2011, Part 1.2.1 Measurement of concentrations and Part 1.2.2 Calculation of the average daily flow.

[49] The "remark codes", defined in the SANDRE, make it possible to clarify an analysis result by indicating if the result obtained is lower than a threshold, or if there are traces present.

[50] For remark code analyses 2, 7 and 10, the value of the result returned by the operator should normally correspond to the value of the detection limit or the QL.

[51] Only one case was found in the data.

4.2 CALCULATION OF THE AVERAGE DAILY FLOW (ADF)

$$ADF = 10^{-3} \times \frac{C1 \times D1 + C2 \times D2 + \ldots + Ci \times Di}{i}$$

With:

- ADF: average daily flow in g/d
- Di: Release rate measured during sampling i (i^{th} measurement campaign) in m^3/d
- Ci: Concentration measured during sampling i (i^{th} measurement campaign) (same rules as those mentioned above) in µg/l
- i: sampling number (measurement campaign)

However, the note of 27 April 2011 indicates the following rule: "*in the event of an average concentration below the QL, the average daily flow is considered to be zero*". Thus, if the associated WAC, calculated as described above, is less than the "prescribed QL", i.e. the quantification limits defined in Appendix 5.2 of the circular of 5 January 2009[52], then the calculated ADF is taken as equal to 0.

➢ Calculation of the average daily flow of a site with several release points:

Some sites have multiple release points. They have therefore carried out measurement campaigns at several sampling points. In these cases, the daily average flow of the site is calculated by totalling the daily average flows for each point of release. It is this total flow value that is then compared to the threshold flows that trigger monitoring and reduction actions (see section 2.3).

As explained in section 3.4 above, some additional points were excluded from the data set under study (when it concerns points made within the sites and if it concerns effluents other than industrial effluent releases) but this has not always been possible. In these latter cases, the calculated total flow may be overestimated with respect to the actual flow of the site's releases. As the percentage of sites concerned by these potential overestimations is low (a little less than 10% of the sites have entered 2 sampling points and only a few sites have more than 2 sampling points), the impact of this aspect on the overall results presented in this report is considered low.

➢ Conversion of release rates:

The release rates used in the calculations must be in m^3/d. However, since the release rate values entered by the operators can be entered in different units (m^3/s or m^3/h), it has been converted into m^3/d for further calculations.

This conversion may lead to a bias for some sites working in batches and not continuously, or not working 24/7.

[52] Circular of 5 January 2009, Appendix 5.2: Quantification limits to be attained.

PART 2: STUDY RESULTS

1. DESCRIPTIVE ANALYSIS OF THE DATA SET

The results presented in this study are based on a **selected** data set covering 3,722 sites (and not on all the available data, see section 3.5.2). Moreover, the framework given by the national circulars (which covered all the ICPEs subject to authorisation and registration, i.e. about 50,000 facilities) may have been adapted by the services of the Administration according to each local context.

As a result, this data set and the results presented do not cover all ICPEs.

This number of sites is of the same order of magnitude as the number of "Water reporting" sites in GEREP, an annual pollutant reporting tool. The data set can be overall considered as a **representation** of the main contributors to industrial aqueous releases at the national level.

1.1 SECTOR-SPECIFIC DISTRIBUTION OF SITES

The Table 5 below indicates the distribution of the 3,722 sites concerned by this study by industrial sector or sub-sector, in descending order of representation.

Some sectors are more widely represented:

- The sector having the highest number of sites is the agri-food industry - products of animal origin with 16% of the facilities in total.
- 12 industrial sub-sectors represent more than 80% of the sites concerned by this assessment.
- Among these, the top 5 industrial sub-sectors cover more than half of the sites (54% precisely): agri-food industry - products of animal origin and products of plant origin excluding wine production, surface treatment and coating industry, chemical industry and mechanical working of metals industry.

Conversely, some sectors are less widely represented:

- 21 industrial sub-sectors (half) represent only 10% of the sites.
- Among these, 8 sectors have less than 10 sites.

Table 5: Sector-specific distribution of sites

Secteurs / Sous-secteurs d'activités	Nombre d'établissement	
17 Industrie agroalimentaire (Produits d'origine animale)	598	
21 Industrie du traitement, revêtement de surface	396	
18.2 Industrie agroalimentaire (Produits d'origine végétale) hors activité vinicole	383	
6 Industrie de la chimie	341	
20 Industrie du travail mécanique des métaux	282	**54%**
1 Abattoirs	195	
3.2 Installations de stockage de déchets non dangereux	186	
12.2 Blanchisseries	157	
18.1 Activité vinicole	146	
3.1 Regroupement, prétraitement ou traitement des déchets dangereux	99	
13.3 Fabrication de papiers/cartons	93	**80%**
3.5 Autres sites de traitement de déchets non dangereux	90	
12.1 Ennoblissement	70	
10 Industrie du plastique	63	
14.4 Production et/ou transformation des métaux non ferreux	59	
3.3 Unité d'incinération d'ordures ménagères	49	
15 Industrie pharmaceutique : Formulation galénique de produits pharmaceutiques	45	
14.1 Sidérurgie	40	
3.4 Lavage de citernes	39	
2.2 Dépôts et terminaux pétroliers	37	
4.3 Autres activités de l'industrie du verre	35	
5 Centrales thermiques de production d'électricité	33	
14.3 Fonderies de métaux non ferreux	33	
4.1 Fusion du verre	32	
11 Industrie du caoutchouc	30	
22 Industrie du bois	27	
19 Industrie du traitement des cuirs et peaux	24	
25 Installations de séchage de prunes	20	
23 Industrie de la céramique et des matériaux réfractaires	18	
16 Industrie de l'imprimerie	18	
14.2 Fonderies de métaux ferreux	17	
24 Industries du traitement des sous-produits animaux	17	
2.1 Raffinage	14	
8 Fabrication de peintures	9	
7 Fabrication de colles et adhesifs	6	
9 Fabrication de pigments	5	
13.1 Préparation de pâte chimique	4	
2.3 Industries pétrolières : sites de mélanges et de conditionnement de produits pétroliers	4	
13.2 Préparation de pâte non chimique	3	
2.4 Industries pétrolières : sites de synthèse ou de transformation de produits pétroliers (hors pétrochimie)	3	**10%**
4.2 Cristalleries	2	
TOTAL des 41 secteurs / sous-secteurs activités	**3722**	

This sector-specific distribution should be kept in mind when interpreting the results, particularly on the lessons learnt at the sectoral level (for example when comparing the contribution of the different sectors, in section 2.3.2 and section 0 in particular).

The presentation of the number of analyses by industrial sector slightly modifies the “ranking” since the chemical sector represents the most analyses (about 14% of the analyses). This large number of analyses can be partly explained by the fact that no sector-specific list has been established for this sector and that some sites have measured all the substances (more than 100) at least once.

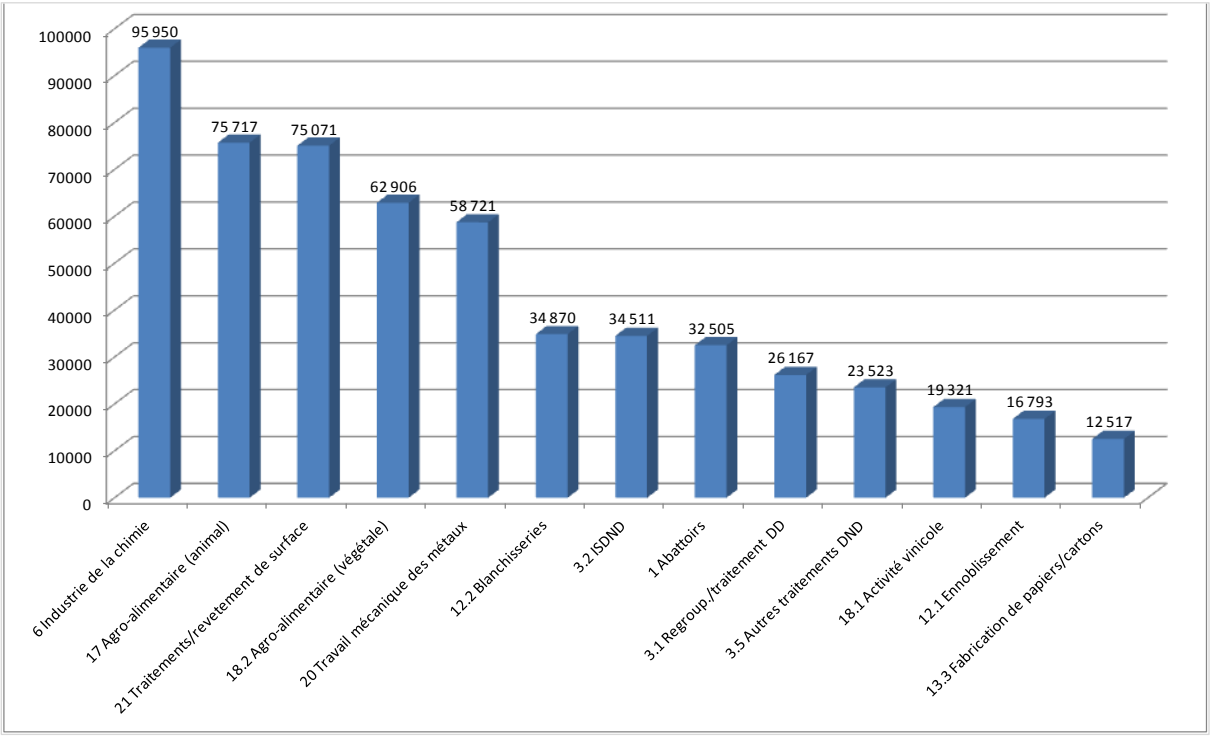


Figure 3: Number of analyses by industrial sector (sectors representing more than 80% of analyses)

1.2 GEOGRAPHICAL DISTRIBUTION OF SITES

The following map (Figure 4) represents the geographical distribution of the sites in the territory. The regions with the largest number of sites are Rhône-Alpes, Nord-Pas-de-Calais, Ile-de-France and the regions of western France.

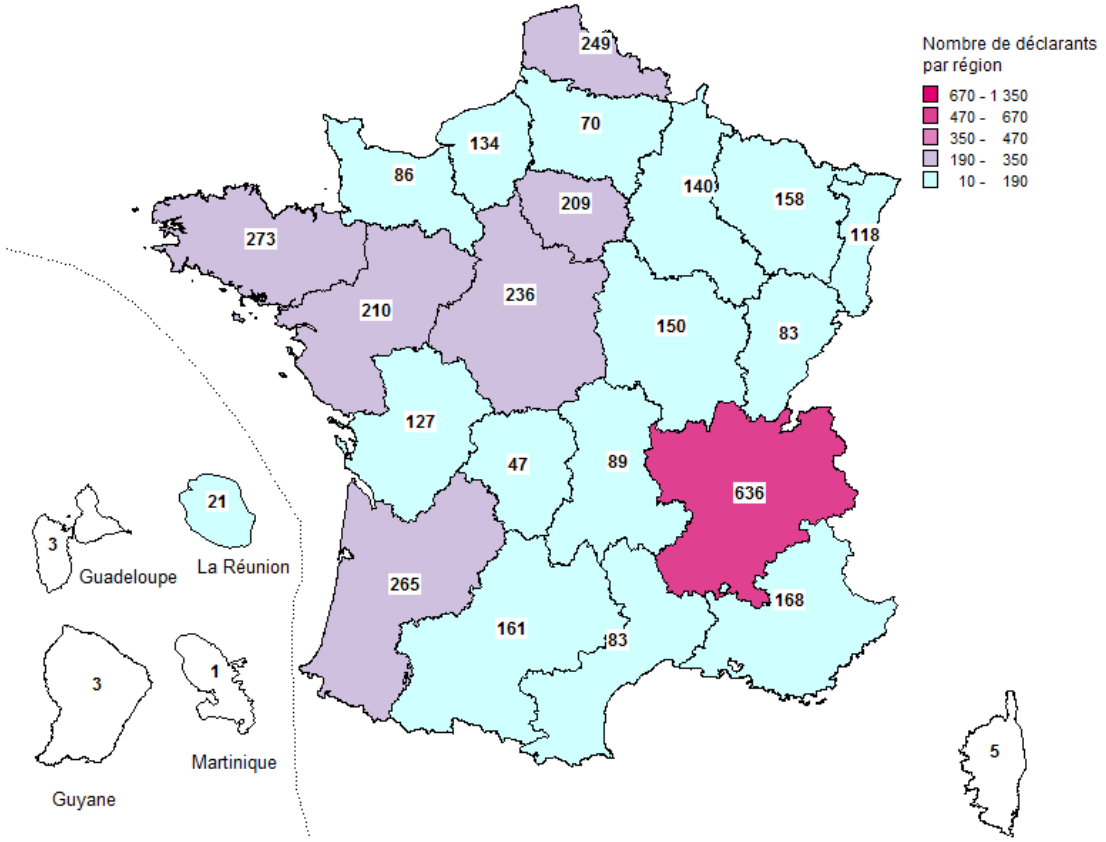


Figure 4: Geographical distribution of sites

1.3 NUMBER OF SUBSTANCES MEASURED

On average, 29 substances were measured at each sampling.

The following two graphs show the number of analyses performed on the different families of substances and then on the different categories of substances.

In both cases, the observed distributions are directly linked to the sector-specific lists defined in the circular of 5 January 2009 which prescribes the substances to be tested for (the families or categories of substances which stand out as the most analysed are those that have been prescribed in the largest number of sector-specific lists).

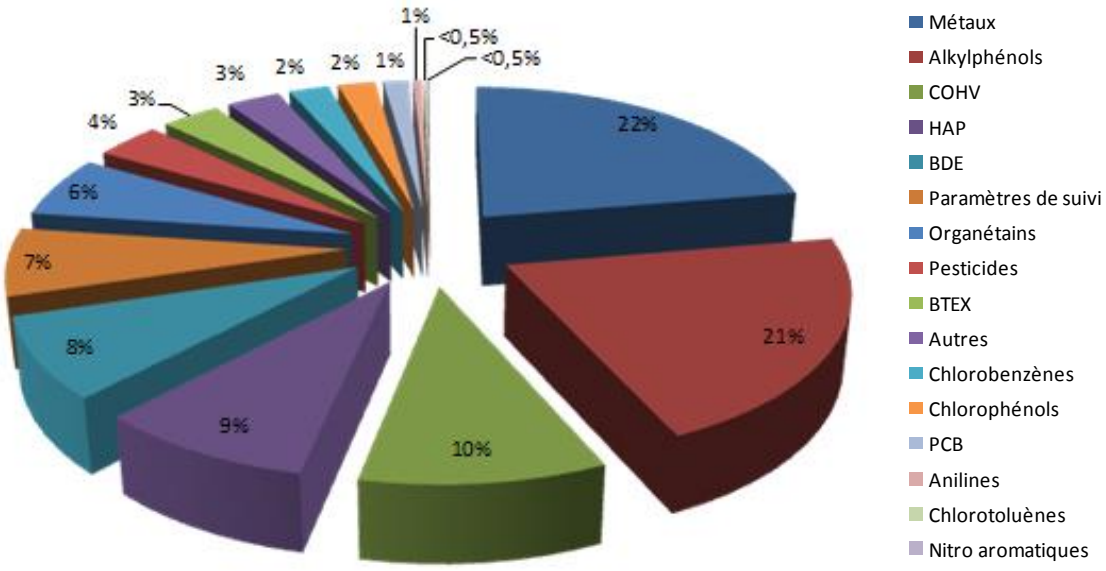


Figure 5: Number of measurements carried out per family of substances

All families of substances were measured but metals and alkylphenols are the most represented.

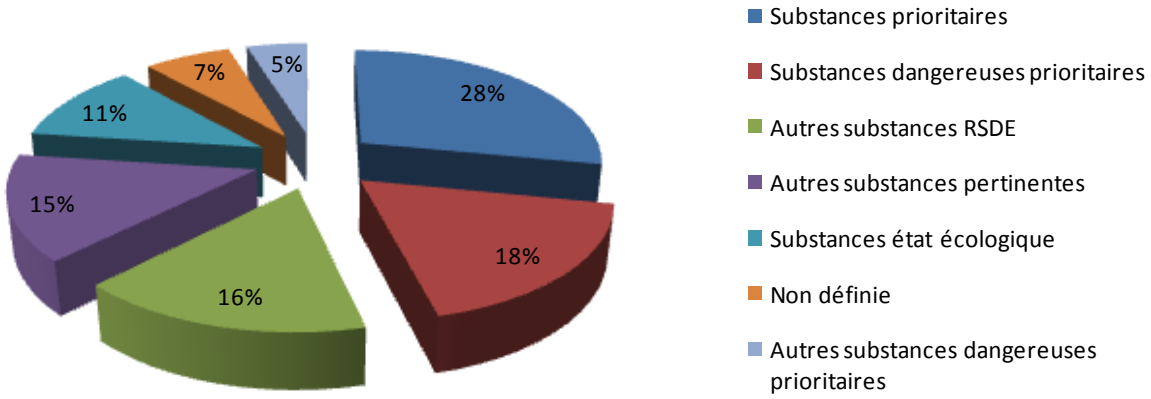


Figure 6: Number of measurements carried out per category of substance[53]

The analyses carried out on the priority hazardous substances and the priority substances represent 51% of the analyses carried out (28%, 5% and 18%).

[53] The categories of substances tested for are explained in section 2.3.2. It should be noted that the categories of substances indicated in this report are those indicated in the circular of 5 January 2009. However, these categories have been modified for certain substances by Directive 2013/39/EU, amending the Water Framework Directive 2000/60/EC (for example some substances previously classified as “priority” are now classified as “priority hazardous substances”, such as the following brominated diphenyl ethers: BDE 47, BDE 153, BDE 154).

2. SUMMARY OF THE INITIAL MONITORING RESULTS

The objective of this section is to present a summary of the main results for all substances and sites selected in this study.

More detailed analyses of some substances or families of substances are presented in section 0.

Finally, detailed results by substance and sector are available in two documents annexed to this report (Reports INERIS-DRC-16-149870-01979B and INERIS-DRC-16-149870-01981B).

2.1 PRESENCE OF SUBSTANCES IN RELEASES

Among all the substances, approximately 30% of the analyses result in a quantified result.

2.1.1 MOST FREQUENTLY QUANTIFIED SUBSTANCES

In order to shed light on the recurrent presence of a given substance in the sites' aqueous releases, it was proposed to study the sites that **quantified the substance at least 3 times** over the entire initial monitoring campaign, i.e. sites for which the substance has been quantified in at least 50% of the samples. This number of sites is then compared to the total number of sites that have carried out **at least 3 measurements** in order to obtain the percentage of sites in which the substance has been quantified (subsequently named as quantification frequency).

The graph below shows, for each substance, the percentage of sites that quantified the substance at least 3 times, in descending order and when this percentage is at least 10%.

Note: Please note that **the 112 substances were not systematically tested for by each site** (see 2.3.3 on the sector-specific lists). The detailed results, also indicating the number of sites that quantified and tested for each substance at least 3 times, are available in Appendix 2.

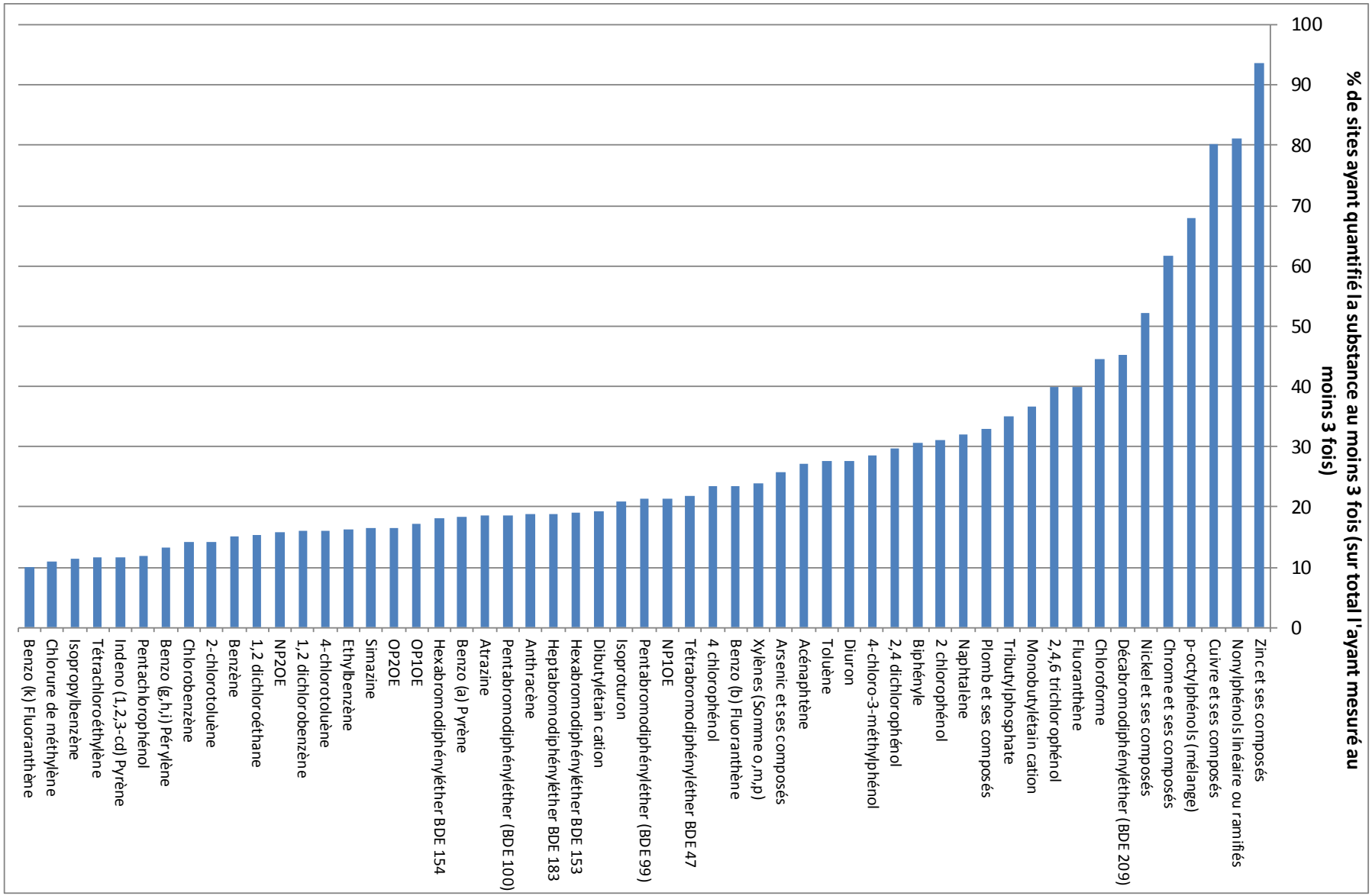


Figure 7: Substances that were quantified at least three times by at least 10% of the sites

It shows that:

- **55 substances** (out of 112), including 12 priority hazardous substances, 21 priority substances, 4 specific pollutant of the ecological statuss and 18 relevant substances, were quantified at least 3 times by more than 10% of the sites.
- **Zinc**, **nonylphenols** and **copper** were quantified at least 3 times by more than 70% of the sites.
- 13 substances were quantified at least 3 times by 30 to 70% of sites, including **octylphenols**, 3 **metals** (chromium, nickel and lead), decabromodiphenyl ether (**BDE-209**), **chloroform**, 2 PAHs (**fluoranthene** and **naphthalene**), 2 **chlorophenols** (2,4,6-trichlorophenol and 2-chlorophenol), **monobutyltin cation**, **tributylphosphate** and **biphenyl**.
-

2.1.2 LEAST FREQUENTLY QUANTIFIED SUBSTANCES

Conversely, using the same quantification frequency indicator as in the previous section 2.1.1, in order to identify the least frequently quantified substances, we find that:

- **57 substances** (out of 112) were measured at least three times by less than 10% of the sites. Among them, there are 13 priority hazardous substances, 7 priority substances and 37 relevant substances.
- 36 of these substances are systematically tested for only by the chemical sector. The detailed results, that indicate the number of sites that quantified and tested for these substances at least 3 times, are available in Appendix 2.
- Two metals **cadmium** and **mercury** were quantified at least 3 times by 8% and 5% of the sites respectively.
- There are also 7 **PCBs** [54], 2 **aromatic nitro compounds**, 5 **anilines**, 11 **chlorobenzenes** out of 13 and 8 **pesticides** out of 12.
- The following **12 substances** have **not** been quantified at least 3 times by **any site** (but have been tested for by only 50 to 80 sites around): 3 priority substances (chlorfenvinphos, trifluralin and 1,3,5-trichlorobenzene) and 9 relevant substances: PCB 28, epichlorohydrin, 5 HVOCs (1,1-dichloroethylene, hexachloropentadiene, 1,1-dichloroethane, 3-chloroprene (allyl chloride), chloroprene), 1-chloro-3-nitrobenzene and 4-chloro-2-nitroaniline.

[54] PCBs were not often tested for in the second phase of the RSDE2 action (see section 2.3.2). The detailed analysis of the results showed that some sites (dealing with transformers for example) did not test for PCBs. The results for these substances may therefore be underestimated (in terms of quantification frequency as well as long-term monitoring and reduction studies).

2.2 RELEASE LEVELS

The objective of this part is to present overall the observed release levels in weighted average concentration (WAC) and average daily flows (ADF).

The results are expressed using percentiles[55] to show the distribution of the release levels on all of these points.

Examples for WACs:

- 90th percentile: 90% of the release points have a WAC lower than the 90th percentile value (and 10% have a higher WAC).
- 50th percentile: equivalent to the median. 50% of the release points have a WAC lower than the 50th percentile value (and 50% have a higher WAC).

2.2.1 DISTRIBUTION OF AVERAGE CONCENTRATIONS (WAC)

The table below presents the distribution of the WAC results measured at all the points of release[56] in which each substance was tested for (distribution presented in descending order on the 90th percentile value, with a selection of the substances having a WAC greater than 1 µg/l in the 90th percentile). Detailed results for all substances are given in Appendix 3.

Table 6: Release Levels: distribution of weighted average concentrations of all release points

	WAC (µg/l)				
Substance	**50th percentile**	**75th percentile**	**90th percentile**	**Maximum**	**"Circular" QL (µg/l)**
Zinc and its compounds	109	287	731	47 273	10
Copper and its compounds	19	54	154	46 990	5
Nickel and its compounds	< QL	23	126	183 276	10
Chromium and its compounds	6	18	77	149 660	5
Chloroform	< QL	5	29	33 264	1
Xylenes (total o, m, p)	< QL	< QL	25	23 339	2
Lead and its compounds	< QL	6	20	299 802	5
Toluene	< QL	2	17	208 997	1
Arsenic and its compounds	< QL	< QL	16	1 358	5
Methylene chloride	< QL	< QL	10	232 260	5
Nonylphenols	0.4	2	5	20 149	0.1
4-Chloro-3-methylphenol	< QL	< QL	3	4 932	0.1
Benzene	< QL	< QL	3	8 758	1
Ethylbenzene	< QL	< QL	3	3 660	1
1,2-Dichloroethane	< QL	< QL	3	1 254	2
Chlorobenzene	< QL	< QL	2	12 629	1
NP1EO	< QL	0.2	1	1 854	0.1

[55] A centile or percentile is each of the 99 values that divide the sorted data into 100 equal parts, so that each part represents 1/100 of the data sample.

[56] From the perspective of all the points of release and not of all the sites. Indeed, as explained before, some sites have several points of release. However, for the study of release levels, it is more relevant to study each release point separately, rather than aggregate releases.

- It is noted that 17 substances (including 2 priority hazardous substances, 6 priority substances, 4 specific pollutant of the ecological statuss and 5 relevant substances) were released with a WAC greater than 1 µg/l for at least 10% of the release points where they were tested for.
- Among them, we find **6 metals** out of the 8, **BTEXs**, HVOCs (**chloroform**, **methylene chloride** and **1,2-dichloroethane**), **nonylphenols** and NP1EO, **chlorobenzene** and **4-chloro-3-methylphenol**.
- In terms of release levels, it can be noted that the 50th percentile is less than or close to the QL imposed by the circular[57] (except for zinc, copper and nonylphenols). This observation is still valid in the 75th percentile for half of these 17 substances.
- The 90th percentile is less than 30 µg/l for all substances except for the first 4 which are metals.
- In addition, 29 substances have a WAC lower than 1 µg/l in the 90th percentile and 66 substances have a WAC lower than the quantification limit in the 90th percentile.
- Finally, there is a strong dispersion of the data and an exponential increase of the WACs between the 90th percentiles and the maximum values[58]. Detailed results analyses for certain substances at stake (see section 3) provide a more precise view of this dispersion of release levels.

  One of the explanatory elements of this data distribution lies in the fact that direct and indirect releases are not distinguished here, since direct releases are likely to have undergone a treatment which in most cases had a reduction action on micropollutant concentrations.

[57] Circular of 5 January 2009, Appendix 5.2: Quantification limits to be attained.

[58] It is recalled that data qualification was carried out in order to confirm as much as possible the highest values. However, these could not be verified/ corrected in all cases and therefore there may still be some erroneous values.

2.2.1.1 FOCUSING ON PRIORITY HAZARDOUS SUBSTANCES

The table below presents the distribution of the WAC results measured at all the points of release in which each substance was tested for (distribution presented in descending order on the 90th percentile value, with a selection of priority hazardous substances).

Table 7: Release Levels: distribution of weighted average concentrations of all release points for priority hazardous substances

	WAC (µg/l)				
Substance	**50th percentile**	**75th percentile**	**90th percentile**	**Maximum**	**"Circular" QL (µg/l)**
Nonylphenols	0.4	2	5	20 149	0.1
Tetrachlorethylene	< QL	< QL	0.8	8 320	0.5
Benzo(b)fluoranthene	< QL	< QL	0.05	205	0.01
Anthracene	< QL	0.01	0.04	125	0.01
Benzo(a)pyrene	< QL	< QL	0.03	183	0.01
Tributyltin cation	< QL	< QL	0.03	4	0.02
Benzo(ghi)perylene	< QL	< QL	0.02	108	0.01
Indeno(1,2,3-cd)pyrene	< QL	< QL	0.02	142	0.01
Benzo(k)fluoranthene	< QL	< QL	0.02	83	0.01
Trichlorethylene	< QL	< QL	< QL	3 902	0.5
Cadmium and its compounds	< QL	< QL	< QL	985	2
Carbon tetrachloride	< QL	< QL	< QL	253	0.5
Mercury and its compounds	< QL	< QL	< QL	39	0.5
Pentabromodiphenyl ether (BDE-99)	< QL	< QL	< QL	10	0.05
Pentabromodiphenyl ether (BDE-100)	< QL	< QL	< QL	10	0.05
Hexachlorobutadiene	< QL	< QL	< QL	4	0.5
alpha-Endosulfan	< QL	< QL	< QL	3	0.02
beta-Endosulfan	< QL	< QL	< QL	2	0.02
Hexachlorobenzene	< QL	< QL	< QL	2	0.01
Pentachlorobenzene	< QL	< QL	< QL	1	0.02
alpha-Hexachlorocyclohexane	< QL	< QL	< QL	1	0.02
gamma isomer Lindane	< QL	< QL	< QL	0.8	0.02

In terms of release levels, for priority hazardous substances, 75th percentile WACs are found to be below the quantification limit for all substances except 3 and are below 50 ng/l for all substances in the 90th percentile with the exception of nonylphenols and tetrachlorethylene.

These results shed a particular light on the objective of the Water Framework Directive on the long-term elimination of releases of priority hazardous substances since, with regard to industrial releases, a minority of sites are concerned by these substances apart from nonylphenols.

2.2.1.2 COMPARISON OF MEASURED RELEASE LEVELS (WAC) WITH REFERENCE VALUES FOR AQUATIC ENVIRONMENTS

Environmental Quality Standards (EQS) are defined in the regulatory context of the Water Framework Directive (WFD). In order to prevent and reduce water pollution, concentrations in the environment are compared to an EQS, defined as the "concentration of a pollutant or group of pollutants in water, sediments or biota that must not be exceeded, in order to protect human health and the environment".

Thus, EQS are used for two types of evaluation[59]:

- Evaluation of the chemical status of water bodies, with regard to the "priority" and "priority hazardous" substances of the WFD.
- Evaluation of the ecological status, with regard to specific pollutants of the ecological status and whose list is established at national level.

Although not directly extrapolable outside of each specific situation, the comparison of the concentration release levels with the value of 10 EQS can illustrate a potential impact of releases locally relative to the receiving environment[60].

Thus, the table below presents the release levels and the distribution of the weighted average concentrations of substances for which at least 10% of release points exceed 10 EQS[61] in flow-weighted average concentrations (for substances with an EQS available[62]). Weighted average concentration percentiles from which values exceed 10 EQS are identified in colour.

[59] Transposition into French law in order of 25 January 2010 on the methods and criteria for assessing the ecological status, the chemical status and the ecological potential of surface water under Article R. 212-10, R. 212-11 and R. 212-18 of the Environmental Code.

[60] The note of 27 April 2011 proposed criteria for maintaining substances under long-term monitoring (in section 2.1.2) and reduction studies (in section 2.2.2) with regard to "taking the environment into account", which would translate into a local impact, for direct releases into the natural environment. Among the arguments that could lead to such maintenance, one of the aspects to be taken into account was the following: "concentrations in the series of measurements measured at values greater than 10 EQS". This comparison to the 10 EQS value has been applied here to flow-weighted average concentrations.

[61] The EQS that have been used are fresh water EQS-MAs (annual average EQS, in µg/Ll). When several values are available (depending on water hardness for example), the most stringent value has been chosen.

In addition, these "*standards apply to raw water (unfiltered), with the exception of the metals for which they relate to the dissolved fraction [...]*" (order of 25 January 2010). However, in the context of the RSDE action, the metal concentrations are measured in raw water, corresponding to the dissolved and particulate fractions.

[62] Some substances do not have an EQS or these are for the biota and not for the water compartment. The comparison of the release levels with the EQS is therefore not carried out for these substances.

Table 8: Release Levels: distribution of weighted average concentrations and comparison with EQS

	WAC (µg/l)						
Substance	**25th percentile**	**50th percentile**	**75th percentile**	**90th percentile**	**Max**	**"Circular" QL (µg/l)**	**EQS[63] (µg/l)**
Zinc and its compounds	33	109	287	731	47 273	10	3.1
Copper and its compounds	6	19	54	154	46 990	5	1.4
Nickel and its compounds	< QL	< QL	23	126	183 276	10	4
Chromium and its compounds	< QL	6	18	77	149 660	5	3.4
Chloroform	< QL	< QL	5	29	33 264	1	2.5
Lead and its compounds	< QL	< QL	6	20	299 802	5	1.2
Nonylphenols	< QL	0.4	2	5	20 149	0.1	0.33 [64]
Fluoranthene	< QL	< QL	0.032	0.116	426	0.01	0,0063
Benzo(a)pyrene	< QL	< QL	< QL	0.0274	183	0.01	0.00017
Tributyltin cation	< QL	< QL	< QL	0.0267	4	0.02	0.0002

- It is noted that **10 substances** (including 3 priority hazardous substances, 4 priority substances, 3 specific pollutant of the ecological statuss) were released with a WAC greater than 10 EQS in the 90th percentile, or for at least 10% of the release points.
- Among these substances, there are **5 metals** and **chloroform** for which the EQS is between 1 and 3.4 µg/l.
- For the 4 other substances, the EQS values are lower than 1 µg/l and go to very low levels, of the order of 10^{-1} µg/l for **nonylphenols**, 10^{-3} µg/l for **fluoranthene** and 10^{-4} µg/l for **benzo(a)pyrene** and **tributyltin cation**. For these last 3 substances, the EQS is lower than the QL to be respected indicated in the circular[65].
- The table shows that zinc and copper the 2 most found substances in the releases, are released with weighted average concentrations higher than 10 EQS, for more than 75% and 50% of the releases respectively. Conversely, for other substances, less than 10% of releases have weighted average concentrations above 10 EQS.

[63] The EQS for the following substances (among the substances in the table) have been lowered between Directive 2008/105/EC and Directive 2013/39/EC: nickel EQS from 20 µg/l to 4 µg/l, lead EQS from 7.2 µg/l to 1.2 µg/l, benzo(a)pyrene EQS from 0.05 µg/l to 0.00017 µg/l , fluoranthene EQS from 0.1 µg/l to 0.0063 µg/l.

[64] The EQS for nonylphenols normally applies to each of the parameters measured under the SANDRE 1957, 1958 and 5474 codes. However, the WACs presented here concern the SANDRE 6598 code parameter: sum of the 1957 and 1958 SANDRE codes. These results are therefore "overestimated" compared to the EQS.

[65] Circular of 5 January 2009, Appendix 5.2: Quantification limits to be attained.

2.2.2 DISTRIBUTION OF AVERAGE FLOWS (ADF)

2.2.2.1 DISTRIBUTION OF RELEASE RATES

The Table 9 below shows the distribution of daily flow rates[66] measured throughout all the measurement campaigns performed.

Table 9: Distribution of average flows of all the points of release

Average flow rates (m^3/d)				
10th percentile	**25th percentile**	**50th percentile**	**75th percentile**	**90th percentile**
5	18	79	324	1 418

Measured flow rates are found to be less than about 350 m^3/d for at least 75% of the release points and less than about 1500 m^3/d for 90% of the release points.

Measured flow rates are up to an order of magnitude of 10^5 m^3/d. As for the weighted average concentrations, there is therefore a strong dispersion of the data, the rates increasing exponentially from the 90th percentile.

In addition, the table in Appendix 3 shows the distribution of average flow rates for each sector. The flows are very heterogeneous according to the industrial sector concerned and are directly related to their needs/uses/water inputs.

2.2.2.2 DISTRIBUTION OF AVERAGE DAILY FLOWS (ADF)

The Table 10 below presents the distribution of the ADF results calculated at all the points of release in which the substance was tested for (presented in descending order on the 90th percentile value, and with a selection of the substances having an ADF greater than 1 g/d in the 90th percentile[67]).

Table 10: Release levels: distribution of average flows of all the points of release

	Average flow (g/d)				Flow thresholds (g/d) triggering:	
Substance	**50th percentile**	**75th percentile**	**90th percentile**	**Max**	**Long-term Monitoring**	**Reduction Study**
Zinc and its compounds	13	53	160	37 620	200	500
Copper and its compounds	1	7	30	3 618	200	500
Nickel and its compounds	0	2	16	6 662	20	100
Chromium and its compounds	0.2	2	11	81 365	200	500
Chloroform	0	0.7	6	8 520	20	100
Lead and its compounds	0	0.1	2	73 839	20	100
Xylenes (total o, m, p)	0	0	2	4 097	300	500
Toluene	0	0.05	2	11 262	300	1 000
Arsenic and its compounds	0	0	2	2 413	10	100

[66] We remind that flows are calculated from measured concentrations and flow releases.

[67] Detailed results on all the substances are given in Appendix 5.

Nonylphenols	0.03	0.2	1	508	2	10

It is found that:

- 10 substances (including 1 priority hazardous substance, 3 priority substances, 4 specific pollutant of the ecological statuss and 2 relevant substances) were released with an average flow greater than 1 g/d for at least 10% of the release points where they were tested for.
- Among them, we find **6 metals** among the 8 tested for, **chloroform**, **xylenes** (total o, m, p), **toluene** and **nonylphenols**.
- These same substances also show up with the highest 90th percentile weighted average concentrations (see section 2.2.1).
- All 90th percentiles are below the thresholds that trigger long-term monitoring (let alone reduction studies), i.e. less than 10% of release points are affected by the implementation of actions for each substance.
- Some average flows are high (see maximum average flow)[68]. Some high flows are due to a high flow rate (not a high concentration). Regarding lead, one site accounts for 81% of the total flow (main emitter). Detailed results analyses for certain substances at stake (see section 3) provide a more precise view of this dispersion of release levels.

2.3 FLOWS EXCEEDING THE LONG-TERM MONITORING AND REDUCTION STUDY ACTION THRESHOLDS

The objective of this section is to present the flows that exceed long-term monitoring and reduction study thresholds by indicating the percentage of sites involved, and which substances and sectors are affected by these actions.

It should be noted that the figures presented in this section only concern flows **that exceed the thresholds** defined in Appendix 2 of the note of 27 April 2011 (see section 6.2.3). However, in some places, other criteria may have led to the prescription or non-prescription[69] of long-term monitoring or reduction studies (see section 2.4). These criteria, concerning a local application of the action, cannot be taken into account here, because they are not reported in the database. The number and rate of long-term monitoring and action programmes actually prescribed on the ground are therefore inevitably different.

Among the 3,722 sites selected within the framework of this analysis:

- **897 sites** (**24%**) have releases that exceed the long-term monitoring thresholds for one or more substances;
- **358 sites** (**10%**) have releases that exceed the reduction study thresholds for one or more substances.

2.3.1 FLOWS EXCEEDING ACTION THRESHOLDS PER SUBSTANCE

Comprehensively, **55 substances** or groups of substances are released (by at least one site) at flow levels that exceed the long-term monitoring thresholds, including **44** that also exceed the reduction study thresholds (i.e. 56% and 45% of substances).

[68] It is recalled that data qualification was carried out in order to confirm as much as possible the highest values. However, these could not be verified/ corrected in all cases and therefore there may still be some erroneous values.

[69] For example, for the special cases of effluent spreading, a reduced device compared to the application of the comparison criterion to the trigger threshold flow of reduction studies (criterion in column B) can be set up according to piezometric monitoring of the relevant groundwater body.

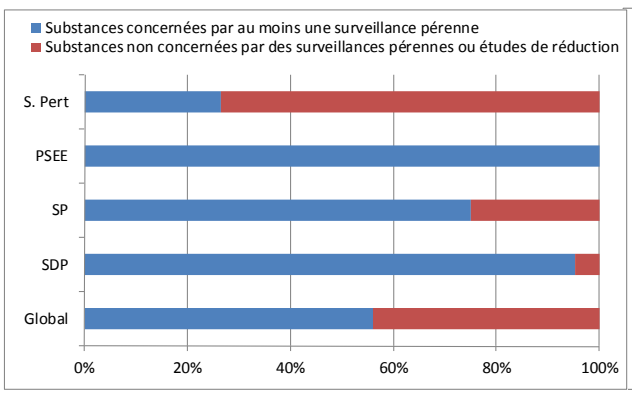
Conversely, **54 substances** or groups of substances are <u>not</u> released at flow levels above the reduction study thresholds, including **43** that do <u>not</u> exceed the long-term monitoring thresholds (i.e. 55% and 44% of substances).

2.3.1.1 FLOWS EXCEEDING ACTION THRESHOLDS PER CATEGORY OF SUBSTANCE

The Table 11 below indicates the number of substances or groups of substances released that do or do not exceed the long-term monitoring or reduction study thresholds, giving details by category of substances[70]. These figures are also represented in the Figure 8 below.

Table 11: By category of substance, number of substances or groups of substances released at flow levels that do or do not exceed the long-term monitoring or reduction study thresholds

Category of substances	**Substances that have undergone at least one long-term monitoring action**		Substances that have **undergone at least one reduction study**		Substances that have **not undergone** any **long-term monitoring or reduction study** actions		Substances that have **not undergone** any **reduction study** actions		Total number of substances or groups of substances
Global	55	56%	44	45%	43	44%	54	55%	98
Priority hazardous substances (PHS)	20	95%	17	81%	1	5%	4	19%	21
Priority substances (PS)	18	75%	16	67%	6	25%	8	33%	24
Specific Pollutants of the Ecological Status (PSEE)	4	100%	4	100%	0	0%	0	0%	4
Relevant substances (Rel. subs)	13	27%	7	14%	36	73%	42	86%	49



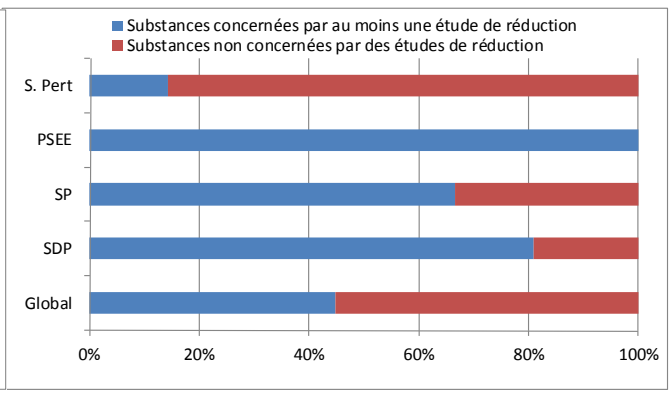


Figure 8: By category of substance, number of substances or groups of substances released at flow levels that do or do not exceed the long-term monitoring (Figure on the left) and reduction study (Figure on the right) thresholds

The breakdown by category of substance shows that a significant proportion of priority hazardous substances, priority substances and specific pollutant of the ecological statuss are affected by at least one long-term monitoring or reduction study. Conversely, a smaller proportion of relevant substances is affected by long-term monitoring or reduction study actions (27% and 14% respectively).

Table 12: Number of long-term monitoring and reduction study thresholds exceeded per category of substances

Category of substances	**Number of long-term monitoring thresholds exceeded**	**Number of reduction study thresholds exceeded**
Priority substances	650	229
Specific pollutants of the ecological status	500	177
Priority hazardous substances	357	118
Other priority hazardous substances	64	46
Other RSDE substances	66	25
Relevant substances	41	23

Aggregate results by category of substance show that relevant substances are affected by a less significant proportion of long-term monitoring and reduction studies compared to other categories of substances (priority hazardous substances, priority substances and specific pollutant of the ecological statuss).

2.3.1.2 FLOWS EXCEEDING ACTION THRESHOLDS PER FAMILY OF SUBSTANCES

In total, on all the substances, there are **1,678** cases of **long-term monitoring** thresholds being exceeded. Among these, **618** exceed the **reduction study** thresholds.

The Table 13 below indicates the number of long-term monitoring and reduction study thresholds exceeded per chemical family of substances[71].

[71] Please note: families of substances and associated substances are detailed in Appendix 1.

Table 13: Number of long-term monitoring and reduction study thresholds exceeded per chemical family of substances.

Families of substances	Number of long-term monitoring thresholds exceeded	Number of reduction study thresholds exceeded
Metals	954	325
HVOC	257	117
Alkylphenols	285	90
BTEX	43	29
PAH	60	15
BDE	10	8
Chlorobenzenes	10	7
Pesticides	17	7
Chlorophenols	5	3
Aromatic nitro compounds	2	1
Anilines	0	0
Chlorotoluenes	0	0
Organotins	0	0
PCB	0	0
Others	35	16

It has been found that the families of substances the most affected by the long-term monitoring and reduction study actions are **mainly metals** (more than half of the long-term monitoring and reduction studies) as well as **HVOCs** and **alkylphenols**.

The families of **anilines**, **chlorotoluenes**, **organotins** and **PCBs** are not affected by long-term monitoring (and a fortiori by the reduction studies).

2.3.1.3 FLOWS EXCEEDING ACTION THRESHOLDS PER SUBSTANCE

The Figure 9 below presents the number of the long-term monitoring and reduction studies thresholds exceeded for each substance (presented in descending order of the number of reduction studies and with a selection of substances affected by more than 5 reduction studies). Detailed results for all substances are given in Appendix 6.

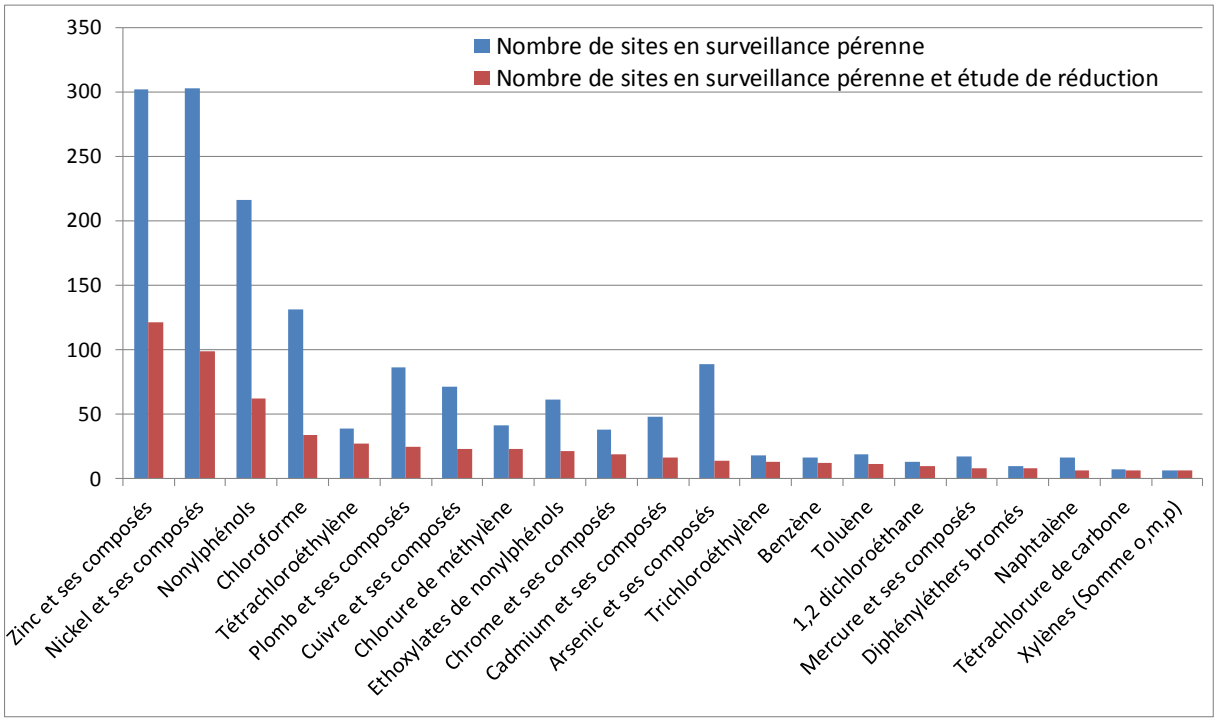


Figure 9: Number of long-term monitoring and reduction study thresholds exceeded per substance

Zinc, **nickel**, **nonylphenols** and **chloroform** are the substances that most often exceed the reduction study and long-term monitoring thresholds, representing 20%, 16%, 10% and 6% of the total number of reduction studies respectively, and 18%, 18%, 13% and 8% of the total number of long-term monitoring actions, i.e. in both cases, more than 50% of the actions.

12 substances account for about 80% of the total number of reduction study thresholds exceeded. They include **7 metals** out of 8 (**zinc** and **nickel** showing more strongly, followed by **lead, copper, chromium, cadmium and arsenic**), **nonylphenols** and **3 HVOCs** (**chloroform, tetrachlorethylene** and **methylene chloride**).

These results are to be brought closer to quantification frequencies. It is noted that these substances are frequently quantified - 26% to 94% of the sites that tested for these substances quantified them at least 3 times in their releases (except cadmium, tetrachlorethylene and methylene chloride). We also note that copper and chromium which are frequently quantified (80% and 62% respectively of sites that have tested for them have quantified them at least 3 times in their releases) appear nevertheless less frequently in long-term monitoring actions and reduction studies (compared to other substances such as zinc or nickel)[72].

[72] These observations remain to be qualified because the monitoring and reduction actions prescribed by “environmental criteria” are not taken into account here.

2.3.2 FLOWS EXCEEDING ACTION THRESHOLDS PER SECTOR

2.3.2.1 DISTRIBUTION OF THE NUMBER OF TIMES REDUCTION STUDY AND LONG-TERM MONITORING THRESHOLDS WERE EXCEEDED BY INDUSTRIAL SECTOR

The Figure 10 below presents the total number and distribution of the number of times the long-term monitoring thresholds were exceeded by industrial sector[73].

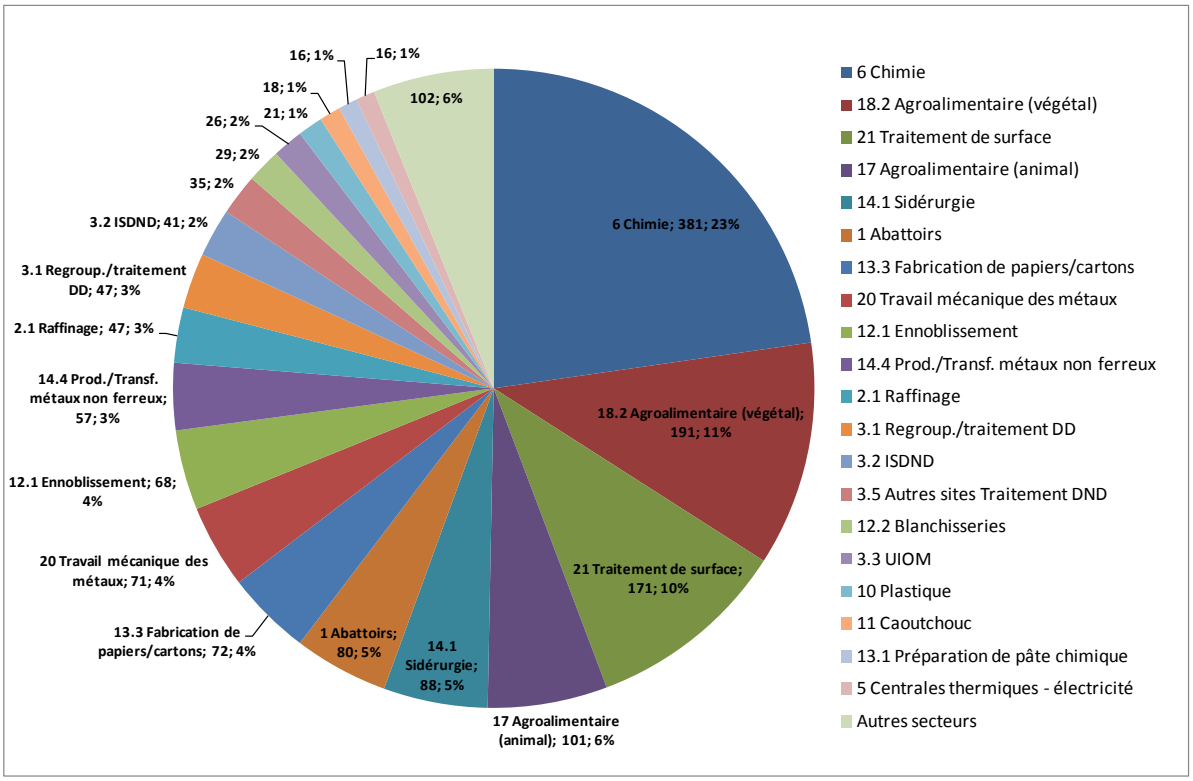


Figure 10: Total number and distribution of the number of times long-term monitoring thresholds were exceeded per industrial sector

The distribution of long-term monitoring is similar to the distribution of reduction studies presented in the following graph apart from the agri-food industry (products of animal origin).

[73] Sectors with fewer than 15 long-term monitoring actions (i.e. less than 1% of the total number of long-term monitoring actions were aggregated in “other sectors”). Detailed results for all sectors are given in Appendix 7.

The Figure 11 below presents the total number and distribution of the number of times the reduction study thresholds were exceeded by industrial sector[74].

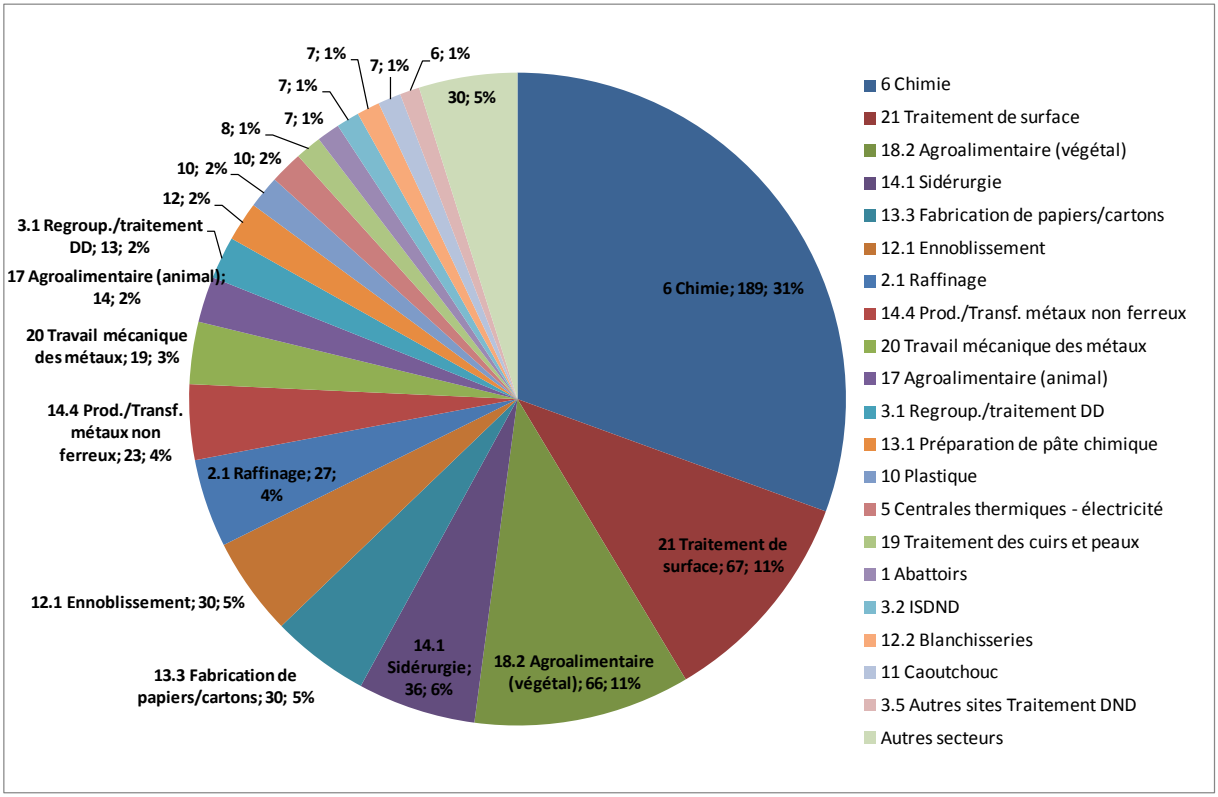


Figure 11: Total number and distribution of the number of times the reduction study thresholds were exceeded by industrial sector

- 3 sectors cover about **50% of the number of reduction study thresholds exceeded**: **chemical**, **surface treatment** and **agri-food industry (products of plant origin)**.
- 11 sectors cover about 80% of the number of reduction study thresholds that were exceeded: from the chemical sector to the mechanical working of metals industry.

  Some of these sectors also represent a large number of base sites (which may partly explain their weight relative to other sectors in the number of reduction studies, see section 0). The 3 sectors covering 50% of the reduction studies represent 1,120 base sites, i.e. 30% and the 11 sectors covering 80% of the reduction studies represent 1,678 base sites, i.e. 45%. Finally, the agri-food sector (products of animal origin) has the largest number of base sites (598 sites, or 16%), but represents only 2% of the reduction studies (14 sites).

[74] Sectors with fewer than 5 reduction studies (i.e. less than 1% of the total number of reduction studies were aggregated in “other sectors”). Detailed results for all sectors are given in Appendix 7.

2.3.2.2 PROPORTION OF SITES WHOSE RELEASES EXCEED THE ACTION THRESHOLDS FOR EACH SECTOR

The following Table 14 indicates for each sector the number of sites whose releases exceed the long-term monitoring or reduction study thresholds for at least one substance as well as the percentage relative to the total number of sites in the sector.

Table 14: Number and proportion of sites whose releases exceed the long-term monitoring or reduction study thresholds for at least one substance for each industrial sector.

Secteurs / Sous-secteurs d'activités	Nombre de sites	Nombre de sites en surveillance pérenne	Nombre de sites en étude de réduction	% de sites en surveillance pérenne	% de sites en étude de réduction
6 Industrie de la chimie	341	142	83	42	24
21 Industrie du traitement, revetement de surface	396	119	56	30	14
18.2 Industrie agro-alimentaire (Produits d'origine végétale) hors activité vinicole	383	91	35	24	9
14.1 Sidérurgie	40	30	21	75	53
12.1 Ennoblissement	70	37	19	53	27
13.3 Fabrication de papiers/cartons	93	41	19	44	20
20 Industrie du travail mécanique des métaux	282	52	18	18	6
17 Industrie agro-alimentaire (Produits d'origine animale)	598	80	12	13	2
14.4 Production et/ou transformation des métaux non ferreux	59	21	10	36	17
2.1 Raffinage	14	12	8	86	57
3.1 Regroupement, prétraitement ou traitement des déchets dangereux	99	26	8	26	8
19 Industrie du traitement des cuirs et peaux	24	12	7	50	29
12.2 Blanchisseries	157	50	7	32	4
10 Industrie du plastique	63	8	6	13	10
3.5 Autres sites de traitement de déchets non dangereux	90	22	6	24	7
1 Abattoirs	195	33	6	17	3
11 Industrie du caoutchouc	30	11	5	37	17
5 Centrales thermiques de production d'électricité	33	10	5	30	15
13.1 Préparation de pâte chimique	4	4	4	100	100
14.3 Fonderies de métaux non ferreux	33	9	4	27	12
3.3 Unité d'incinération d'ordures ménagères	49	15	3	31	6
3.2 Installations de stockage de déchets non dangereux	186	16	3	9	2
9 Fabrication de pigments	5	3	2	60	40
14.2 Fonderies de métaux ferreux	17	5	2	29	12
22 Industrie du bois	27	3	2	11	7
18.1 Activité vinicole	146	5	2	3	1
4.2 Cristalleries	2	2	1	100	50
16 Industrie de l'imprimerie	18	1	1	6	6
4.1 Fusion du verre	32	7	1	22	3
2.2 Dépôts et terminaux pétroliers	37	4	1	11	3
3.4 Lavage de citernes	39	9	1	23	3
15 Industrie pharmaceutique : Formulation galénique de produits pharmaceutiques	45	9	0	20	0
23 Industrie de la céramique et des matériaux réfractaires	18	3	0	17	0
4.3 Autres activités de l'industrie du verre	35	4	0	11	0
24 Industries du traitement des sous-produits animaux	17	1	0	6	0
25 Installations de séchage de prunes	20	0	0	0	0
8 Fabrication de peintures	9	0	0	0	0
7 Fabrication de colles et adhesifs	6	0	0	0	0
2.3 Industries pétrolières : sites de mélanges et de conditionnement de produits pétroliers	4	0	0	0	0
13.2 Préparation de pâte non chimique	3	0	0	0	0
2.4 Industries pétrolières : sites de synthèse ou de transformation de produits pétroliers (hors pétrochimie)	3	0	0	0	0

Colour code:

	% of sites whose releases exceed the long-term monitoring threshold for at least one substance	% of sites whose releases exceed the reduction study threshold for at least one substance
Cells in red	> 50%	> 50%
Cells in yellow	> 30%	> 20%
Cells in green	< 5 %	< 5 %

Sectors in red:	Top 5 sectors in number of sites representing 50% of sites
Sectors in red and brown:	Top 12 sectors in number of sites representing 80% of sites
Sectors in dark green and light green:	Last 21 sectors in number of sites representing 10% of sites
Sectors in light green:	Last 8 sectors in number of sites with fewer than 10 sites

This analysis makes it possible to indicate the percentage of sites exceeding the action thresholds for each sector and to compare, as a first approach, the sectors with each other regarding this rate. Thus we see the following trends:

- More than 50% of the sites in the steel industry and refineries sectors and all chemical pulping sites are involved in at least one reduction study. These sectors share a low number of sites and generally high flow rates (these are the 3 sectors with the highest flow rates in the 90th percentile: higher than 9,000 m^3/d);
- Between 20% and 50% of sites in the following sectors are involved in at least one reduction study: chemicals, paper/cardboard manufacturing, finishing and hides and skins processing industry. The pigment manufacturing and crystal manufacturing sectors also stand out but these have fewer than 10 sites;
- Conversely, less than 5% of sites in the following 8 sectors are involved in at least one reduction study: animal agri-food industry, commercial laundry, slaughterhouses, non-hazardous waste storage facilities, wine production, glass melting, oil depots and terminals, cistern washing. The first 5 sectors bring together many sites (more than 100 sites). Among these agri-food (products of animal origin) and slaughterhouse sectors have a flow rate of about 1000 m^3/d in the 90th percentile while commercial laundry, non-hazardous waste storage facilities and wine production sectors have relatively lower flow rates (less than 400 m^3/d) in the 90th percentile.

Conclusion of section 2.3:

The objective of this section is to present the proportion of sites whose releases exceed the thresholds for long-term monitoring actions and reduction studies and identify for which substances and in which industrial sectors.

24 sites have releases that exceed the long-term monitoring thresholds for one or more substances and 10% exceed the reduction study thresholds.

55 substances or groups of substances are affected by at least one long-term monitoring action including 44 affected by at least one reduction study.

The families of substances the most affected by the long-term monitoring and reduction study actions are mainly metals as well as HVOCs and alkylphenols. The most affected substances in these families are zinc, nickel, nonylphenols and chloroform.

3 industrial sectors cover about 50% of the number of reduction studies: chemicals, surface treatment and agri-food industry (products of plant origin). 11 sectors cover about 80% of these studies.

2.4 MAPPING SUBSTANCES ACCORDING TO THEIR QUANTIFICATION FREQUENCY AND RELEASE LEVELS

The objective of this section is to compare the results in terms of quantification frequency in the ICPEs releases and overall release levels by all sites (cumulative flows).

The idea here is to clarify, according to the substances, to what extent releases of these substances are an overall industrial problem and to target the most relevant actions at a national level (collective actions or targeted actions on a few sites that mainly contribute to emissions).

The Table 15 and table 16 below show a breakdown of substances according to two levels of classification:

- on one hand according to quantification frequency categories;
- on the other hand according to the total flow (cumulated flow) by all the sites, also by category.

The Table 15 concerns priority hazardous substances, priority substances and specific pollutants of the ecological status that were tested for and the table 16 concerns relevant substances.

In addition, a colour code is used to indicate whether the substance is the subject of numerous reduction studies or not.

Finally, the substances for which a primary emitter is observed [75] are identified in italics.

[75] When emissions from the largest emitter account for more than 80% of the total flow of the substance.

Table 15: Distribution of the substances (priority hazardous, priority and specific pollutants of the ecological status tested for) according to the quantification frequency and the total flow (cumulated flow) by all sites, by category.

	Quantification frequency (% of sites that quantified the substance at least 3 times)			
Cumulative flows	**0 - 10%**	**10 - 30%**	**30 - 70%**	**> 70%**
< 1 g/d	Chlorfenvinphos *e*			
	Trifluralin			
	Alachlor			
	1,3,5-Trichlorobenzene			
1 - 10 g/d	*Beta-Endosulfan*	Atrazine		
	Alpha-Endosulfan			
	Tributyltin cation			
	Chlorpyrifos			
10 - 100 g/d	Hexachlorobenzene	Benzo(k)fluoranthene		
	Hexachlorocyclohexane	*Simazine*		
	Pentachlorobenzene	Indeno(1,2,3-cd)pyrene		
		Benzo(ghi)perylene		
		Benzo(a)pyrene		
		Benzo(b)fluoranthene		
100 - 1,000 g/d	*Hexachlorobutadiene*	Isoproturon	p-octylphenols (mixture)	
	Mercury and its compounds	Anthracene	Decabromodiphenyl ether (BDE-209)	
	1,2,3-Trichlorobenzene	Diuron	Fluoranthene	
	Carbon tetrachloride	*Pentachlorophenol*		
	Cadmium and its compounds			
	1,2,4-Trichlorobenzene			
1,000 - 10,000 g/d	Trichlorethylene	Tetrachlorethylene	Naphthalene	Nonylphenols
		Octylphenol ethoxylates	Nonylphenol ethoxylates	
		1,2-Dichloroethane		
10,000 - 100,000 g/d		Arsenic and its compounds	*Chloroform*	Copper and its compounds
		Benzene	Nickel and its compounds	
		Methylene chloride	Lead and its compounds	
> 100,000 g/d			Chromium and its compounds	Zinc and its compounds

Colour code used:

Colour:	**Number of reduction studies:**
	None
	< 10
	10 - 50

	> 50

Table 16: Distribution of relevant substances according to quantification frequency and total flow (cumulative flow) by all sites, by category.

	Quantification frequency (% of sites that quantified the substance at least 3 times)			
Cumulative flows	**0 - 10%**	**10 - 30%**	**30 - 70%**	**> 70%**
< 1 g/d	PCB 118			
	4-Chloro-2-nitroaniline			
	PCB 52			
	1-Chloro-3-nitrobenzene			
	PCB 28			
	Triphenyltin cation			
	Hexachloropentadiene			
	PCB 101			
	PCB 138			
	PCB 180			
	PCB 153			
	3-Chloroprene (Allyl chloride)			
1 - 10 g/d	PCB			
	3-Chlorotoluene			
	1,1-Dichloroethane			
	1,1-Dichloroethylene			
	2,4,5-Trichlorophenol			
	Chloroprene			
	Epichlorohydrin			
	3-Chloroaniline			
10 - 100 g/d	3-Chlorophenol	Isopropylbenzene	2-Chlorophenol	
	1-Chloro-2-nitrobenzene	4-Chlorophenol	2,4,6-Trichlorophenol	
	1,2-Dichloroethylene	4-Chlorotoluene	Monobutyltin cation	
	1-Chloro-4-nitrobenzene	2-Chlorotoluene		
	1,2,4,5-Tetrachlorobenzene	Acenaphthene		
	1,3-Dichlorobenzene			
	Nitrobenzene			
100 - 1,000 g/d	*4-Chloroaniline*	Dibutyltin cation	Biphenyl	
	1,4-Dichlorobenzene	1,2-Dichlorobenzene		
	3,4-Dichloroaniline			
	Hexachloroethane			
	1,1,2,2-Tetrachloroethane			
	2-Chloroaniline			
1 000 - 10,000 g/d	*1, 1, 1-Trichloroethane*	Ethylbenzene	Tributyl phosphate	
	Chloroacetic acid	Chlorobenzene		
	1, 1, 2-Trichloroethane	*4-Chloro-3-methylphenol*		
	2-Nitrotoluene	*2,4-Dichlorophenol*		
	Vinyl chloride			
10,000 - 100,000 g/d		Xylenes (total o, m, p)		
		Toluene		

> 100,000 g/d				

The cross-checking of this information confirms that:

- Metals (zinc, copper, nickel, chromium and lead[76]), nonylphenols, chloroform and naphthalene make up significant releases in cumulative flows (among the micropollutants tested for), are found in the releases of a large number of sites and with reduction actions carried out by several tens or even hundreds of sites;
- In contrast, the substances that are infrequently quantified and overall released in small quantities by all sites are in particular pesticides, tributyltin cation, etc.

[76] For lead and chromium however there are one or two major flow contributors.

2.5 SHARE OF RELEASES FROM SITES EXCEEDING THE REDUCTION STUDY THRESHOLDS FOR THE TOTAL FLOWS MEASURED AS PART OF THE RSDE2 ACTION

This section aims to shed light on how sites that exceed the reduction study thresholds contribute to the total emissions measured for each substance i.e. their share of the total flows measured on all the sites selected for this study.

The following tables (Table 17, Table 18 and Table 19) present by substance category the share of the total flow emitted by the sites in reduction studies out of the total emitted flow (in %) in descending order. The share of the maximum flow (i.e. the site with the highest flow) is also indicated.

The colour code used in these tables is the following:

	Share of the maximum flow (in %)	Share of the total flow emitted by the sites in reduction studies out of the total flow emitted (in %)
Cells in red	> 80 %	> 80%
Cells in yellow	-	60 - 80%

Table 17: Share of releases from sites exceeding the reduction study thresholds for the total flows of priority hazardous substances

Substances	Number of sites that tested for the substance	Number of sites under reduction studies	Share of the maximum flow (in %)	Total flow emitted (g/d)	Total flow emitted by the sites in reduction studies (g/d)	Share of the total flow emitted by the sites in reduction studies out of the total flow emitted (in %)
Tetrachlorethylene	1 432	27	40	5 183	5 108	99%
Nonylphenols	3 104	62	12	4 369	3 272	75%
Trichlorethylene	2 187	13	51	2 398	2 347	98%
Nonylphenol ethoxylates	2 557	21	28	1 906	1 572	82%
Cadmium and its compounds	2 867	16	26	948	749	79%
Carbon tetrachloride	1 684	6	44	356	343	97%
Mercury and its compounds	2 981	8	34	269	205	76%
Hexachlorobutadiene	200	2	85	239	229	96%
Anthracene	1 666	3	37	154	103	67%
Pentachlorobenzene	307	2	89	79	76	96%
Hexachlorocyclohexane	553	2	81	60	55	91%
gamma isomer Lindane	386	1	81	27	17	60%
Benzo(b)fluoranthene	349	1	42	58	24	42%
Benzo(a)pyrene	341	1	44	49	22	44%
Hexachlorobenzene	849	3	32	44	36	82%
Benzo(ghi)perylene	350	1	43	30	13	43%
Indeno(1,2,3-cd)pyrene	343	1	60	28	17	60%

Table 18: Share of releases from sites exceeding the reduction study thresholds for the total flows of priority substances and 4 specific pollutants of the ecological status tested for

Substances	Number of sites that tested for the substance	Number of sites under reduction studies	Share of the maximum flow (in %)	Total flow emitted (g/d)	Total flow emitted by the sites in reduction studies (g/d)	Share of the total flow emitted by the sites in reduction studies out of the total flow emitted (in %)
Zinc and its compounds	3 633	121	8	456 784	309 152	68%
Chromium and its compounds	3 333	19	51	160 478	138 711	86%
Lead and its compounds	3 394	25	81	91 519	86 675	95%
Copper and its compounds	3 575	23	5	76 203	30 317	40%
Nickel and its compounds	3 539	99	9	70 946	57 308	81%
Methylene chloride	1 106	23	27	38 226	36 948	97%
Chloroform	3 069	34	33	25 678	18 627	73%
Benzene	622	12	56	19 735	19 356	98%
Arsenic and its compounds	1 986	14	17	13 855	10 924	79%
1,2-Dichloroethane	236	10	25	8 891	8 763	99%
Octylphenol ethoxylates	1 171	4	96	6 789	6 682	98%
Naphthalene	3 043	6	20	3 971	3 329	84%
1,2,4-Trichlorobenzene	139	1	100	982	981	100%
Pentachlorophenol	899	1	89	626	559	89%
Diuron	544	2	66	514	490	95%
Fluoranthene	3 046	2	27	397	152	38%
1,2,3-Trichlorobenzene	145	1	100	331	331	100%
Brominated diphenyl ethers	1 025	8	19	309	268	87%
p-octylphenols (mixture)	1306	3	29	161	120	75%
Isoproturon	468	2	42	127	104	81%

Table 19: Share of releases from sites exceeding the reduction study thresholds for the total flows of relevant substances

Substances	Number of sites that tested for the substance	Quantification frequency (% of sites that quantified the substance at least 3 times)	Number of sites under reduction studies	Share of the maximum flow (in %)	Total flow emitted (g/d)	Total flow emitted by the sites in reduction studies (g/d)	Share of the total flow emitted by the sites in reduction studies out of the total flow emitted (in %)
Toluene	1 564	28	11	16	69 117	61 385	89%
Xylenes (total o, m, p)	530	24	6	35	11 661	10 204	88%
Vinyl chloride	126	7	2	92	7 037	7 037	100%
2,4-Dichlorophenol	151	30	1	99	6 327	6 272	99%
4-Chloro-3-methylphenol	210	29	1	95	5 121	4 869	95%
Tributyl phosphate	961	35	1	76	4 501	3 434	76%
2-Nitrotoluene	104	2	1	90	3 904	3 516	90%

It was found that this share is greater than 60% for the majority of the substances and even up to 80% for 28 substances. Recommending reduction studies will potentially result in a significant decrease in flows.

In accordance with the initial framework of the RSDE action, these results show that for a large proportion of substances for which sites exceed the reduction study thresholds, releases from these sites generally represent a significant portion of the total flows emitted[77]. Actual reductions in emissions of these substances can be expected by acting on the major contributors.

The only initial monitoring results available in the database do not allow to precise the quantification of the **reduction that can actually be implemented on the ground**. Indeed, not all the reduction studies will lead to the elimination of pollutant releases but to the reduction of releases without this reduction being quantifiable a priori. However the figures given here make it possible to assess whether a reduction in emissions can be expected to a more or less significant extent.

[77] It is also recalled that the sites subject to reduction studies are evaluated here only by comparison with the flow threshold values defined in the note of 27 April 2011. The sites submitted for reduction studies for other criteria are not taken into account.

3. DETAILED ANALYSES OF THE RESULTS FOR SOME SUBSTANCES OR FAMILIES OF SUBSTANCES

The objective of this section is to present detailed analyses of the substances or families of substances at stake, in order to provide useful information for the better management of the emissions of these compounds.

The families of substances and the substances developed hereafter are those that appear in the preceding analyses, namely: substances most frequently quantified and/or substances upon which a large number of long-term monitoring or reduction studies actions are expected,

For substances identified at stake per family, the following information is presented (with greater or fewer details depending on the case):

- global and sectoral quantification frequencies;
- emission levels at all release points;
- industrial sectors contributing to the total flows measured;
- number of sites whose releases exceed the long-term monitoring and reduction study thresholds;
- emission levels at the release points exceeding the reduction study thresholds;

  Note: In some cases, the information presented concerns all the points of release (especially when analysing the emission levels associated with each point of release); and in other cases it concerns all the sites (especially when analysing the cases that exceed the long-term monitoring or reduction study thresholds). As some sites have multiple points of release (see section 3.4), the figures presented in terms of the number of points of release or the number of sites are different.
- summary table of the main uses and possible sources, the regulatory status and some searchable links/ resources (data and elements mainly from the technical economic data sheets produced by INERIS and available on the RSDE website or the INERIS Chemical Substances Portal as well as the INERIS report DRC-14-136882-01394A[78]).

Detailed explanations of the types of graphs and tables presented are developed within the 3.1.1 Zinc section.

Detailed results on each substance are available in two documents annexed to this report (Reports INERIS-DRC-16-149870-01979B and INERIS-DRC-16-149870-01981B).

Studies on the RSDE results were also carried out by several industrial branches on their industrial sectors. Deliverables related to these studies are available on the INERIS RSDE website.

[78] INERIS Report, “Classification of Substances and Measurement Programmes (PDM), Decision Support Elements”, Gouzy A., Denize C., Jéhanne M., Reference INERIS-DRC- 14-136882-01394A, ONEMA - INERIS Convention, 2014.

3.1 METALS

8 metals were tested for as part of the RSDE2 action, including 4 classified as specific pollutant of the ecological status (zinc, copper, chromium and arsenic), 2 as priority substances (nickel and lead) and 2 as priority hazardous substances (cadmium and mercury).

These metals are the most tested for substances (about a third of the analyses in database) and the most frequently quantified: 47% of the measurements carried out are quantified.

These are also the substances that lead to the largest number of long-term monitoring actions and reduction studies: 53% of reduction studies (325) and 57% of long-term monitoring actions (954).

The emission levels of the different metals are shown in the following tables.

Emission levels:

Table 20: Distribution of weighted average concentrations for metals

	WAC (µg/l)					
Substances	**P25**	**P50**	**P75**	**P90**	**Max**	**"Circular" QL (µg/l)**
Zinc and its compounds	33	109	287	731	47 273	10
Copper and its compounds	6	19	54	154	46 990	5
Nickel and its compounds	< QL	< QL	23	126	183 276	10
Chromium and its compounds	< QL	6	18	77	149 660	5
Lead and its compounds	< QL	< QL	6	20	299 802	5
Arsenic and its compounds	< QL	< QL	< QL	16	1 358	5
Cadmium and its compounds	< QL	< QL	< QL	< QL	985	2
Mercury and its compounds	< QL	< QL	< QL	< QL	39	0.5

ELV and BAT-AELs:

Metals are typically included in ministerial orders regulating classified facilities: Ministerial Order of 2 February 1998 [79] which largely covers classified facilities subject to authorisation or Ministerial Orders that specifically cover certain sectors (surface treatment, large combustion plants, paper mills, etc.) and set differentiated values.

In addition, work at the European level for the development and revision of Reference Documents (BREFs) on Best Available Techniques (BAT) tends to strengthen requirements on metals, with emission levels (BAT-AELs) of around a few tens to a few hundred micrograms per litre.

[79] Order of 2 February 1998 on water withdrawals and consumption as well as emissions of all types of facilities classified for the protection of the environment subject to authorisation.

The table in Appendix 9 presents the emission limit values for the 8 metals of the order of 2 February 1998 and the BREF BAT-AELs that was recently published.

Table 21: Distribution of the average flows and number of long-term monitoring actions and reduction studies for metals

	Average flow (g/d)					Number of flow thresholds exceeded triggering:		Flow thresholds (g/d) triggering:	
Substances	**P25**	**P50**	**P75**	**P90**	**Max**	**Long-term monitoring**	**Reduction Study**	**Long-term Monitoring**	**Reduction Study**
Zinc and its compounds	2	13	53	160	37 620	302	121	200	500
Copper and its compounds	0.1	1	7	30	3 618	71	23	200	500
Nickel and its compounds	0	0	2	16	6 662	303	99	20	100
Chromium and its compounds	0	0.2	2	11	81 365	38	19	200	500
Lead and its compounds	0	0	0.1	2	73 839	86	25	20	100
Arsenic and its compounds	0	0	0	2	2 413	89	14	10	100
Cadmium and its compounds	0	0	0	0	243	48	16	2	10
Mercury and its compounds	0	0	0	0	92	17	8	2	5

The analysis of the results on metals makes it possible to formulate the following observations:

- Part of the emissions are due to “background noise” related to materials used in infrastructure or “widespread” uses, particularly for copper and zinc. However, even for these substances, there are large contributors beyond this “background noise”.
- Conversely, cadmium and lead are released by only a few sites.
- Overall, metal emissions are related to their implementation or to consumables (such as catalysts) containing it or raw materials that may contain trace amounts (such as biomass) in industrial processes.
- The agri-food sector (products of plant origin) is one of the top 3 sectors contributing to metal flows. However, a large part of the affected flows come from water spread under the regulations relating to water spreading (return to the ground of the water used to wash vegetable raw materials full of soil). Thus, 4 sites whose measured effluents are spread, represent approximately 60% of the flows of the agri-food industry (products of plant origin) for zinc, copper and nickel, and between 75% and 90% for cadmium, chromium, arsenic and lead.
- Means of action are possible and observed on certain industrial sites and generally consist of:
    - substituting or possibly reducing the use of products containing these metals (such as substituting zinc-containing chemicals used in treatments in cooling towers or other equipment (especially anticorrosive products)),
    - recycling / treatment at the source or pre-treatment[80], directly at the end of processes or workshops,
    - treatment at the final release stage (implementation of treatments or even simply better management of existing effluent treatments).
- Some contributors are significant because of high flows (associated with relatively low concentrations) for which potential sources within the sites should be identified in order to act as closely as possible to these sources.

[80] No real “treatment” for metals as these are usually transferred to sludge.

3.1.1 ZINC

Status of the substance	Specific pollutant of the ecological status (WFD)
EQS	3.1 µg/l or 7.8 µg/l depending on the hardness of the water

Zinc is the most frequently quantified substance overall (94% of sites), and by all the sectors that tested for it (40 sub-sectors out of 41, with quantification frequencies of 60% to 100% - with several sectors at 100%).

Zinc is the substance with the highest emission levels overall (see percentiles in Tables Table 20 and Table 21).

The following graph shows the emission levels of all the points of release from which zinc was tested for.

In this graph showing “emission levels from all points of release”, the points represent the weighted average concentrations (vertical axis) according to the average flows (horizontal axis) for each point of release.

The scale used is in logarithm 10 to allow a better readability of the results, which are highly dispersed. For example:

Log 10	Corresponding value
5	100,000
4	10 000
3	1 000
2	100
1	10
0	1
-1	0.1
-2	0.01
-3	0.001
-4	0.0001
-5	0.00001

The emission limit values of the Ministerial Order of 2 February 1998 [81] and the flow thresholds that trigger long-term monitoring actions and reduction studies are also represented by straight lines.

[81] Order of 2 February 1998 on water withdrawals and consumption as well as emissions of all types of facilities classified for the protection of the environment subject to authorisation.

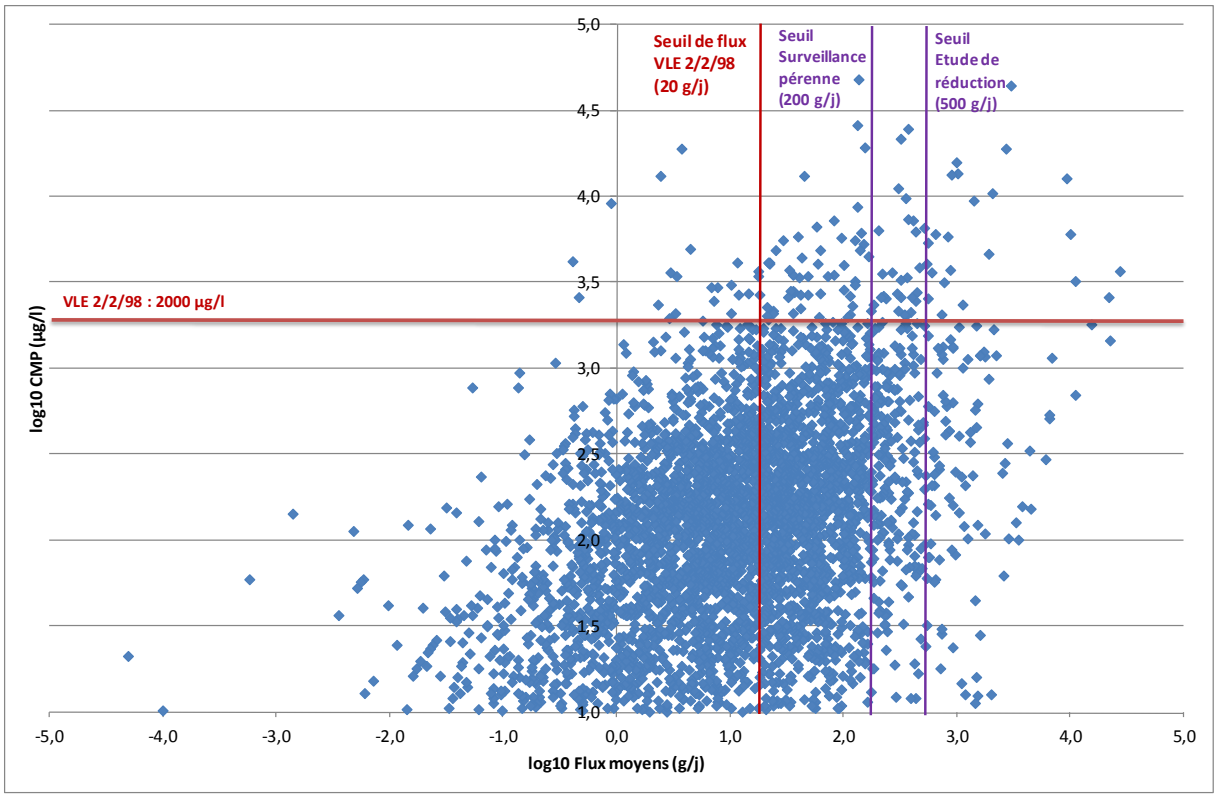


Figure 12: Zinc emission levels at all release points (weighted average concentrations according to average flows)

It helps to shed light on release levels as a whole:

	< ELV AM 02/02/98 (2000 µg/l if flows > 20 g/d)	> 10 EQS (31 µg/l)	> ELV AM 02/02/98 (2000 µg/l if flows > 20 g/d)
Out of 4,180 release points(1)	4082 (98%)	3197 (76%)	98 (2%)
Whose flow > reduction study threshold	105	117	24
Whose flow < reduction study threshold	3977	3080	74

(1) (out of 3,633 sites)

2% of the releases have a WAC higher than the ELV of the Ministerial Order of 2 February 1998. Although this ELV is not applicable to all sites (for example, ELV is not applicable to sectors covered by a specific ministerial order, such as surface treatment), the comparison to this value makes it possible to situate all the releases in relation to a “reference” value.

Many sectors contribute to zinc flows. However, 80% of the total flow is discharged by 8 sectors, including 2 sectors that contribute individually to more than 10% of the total flow (chemicals and the agri-food industry (products of plant origin), 28% and 17% respectively).

Of the 3,633 sites that tested for zinc, 303 exceeded the long-term monitoring thresholds and 121 exceeded the reduction study thresholds[82]. These 121 sites represent 68% of the total flow.

308 sites (8%) account for approximately 80% of the total flow.

Focus on sites that exceed the reduction study thresholds:

The two following graphs show the emission levels at the release points exceeding the reduction study thresholds. The first graph concerns levels of concentrations according to flows and the second graph concerns the levels of flow rates and concentrations.

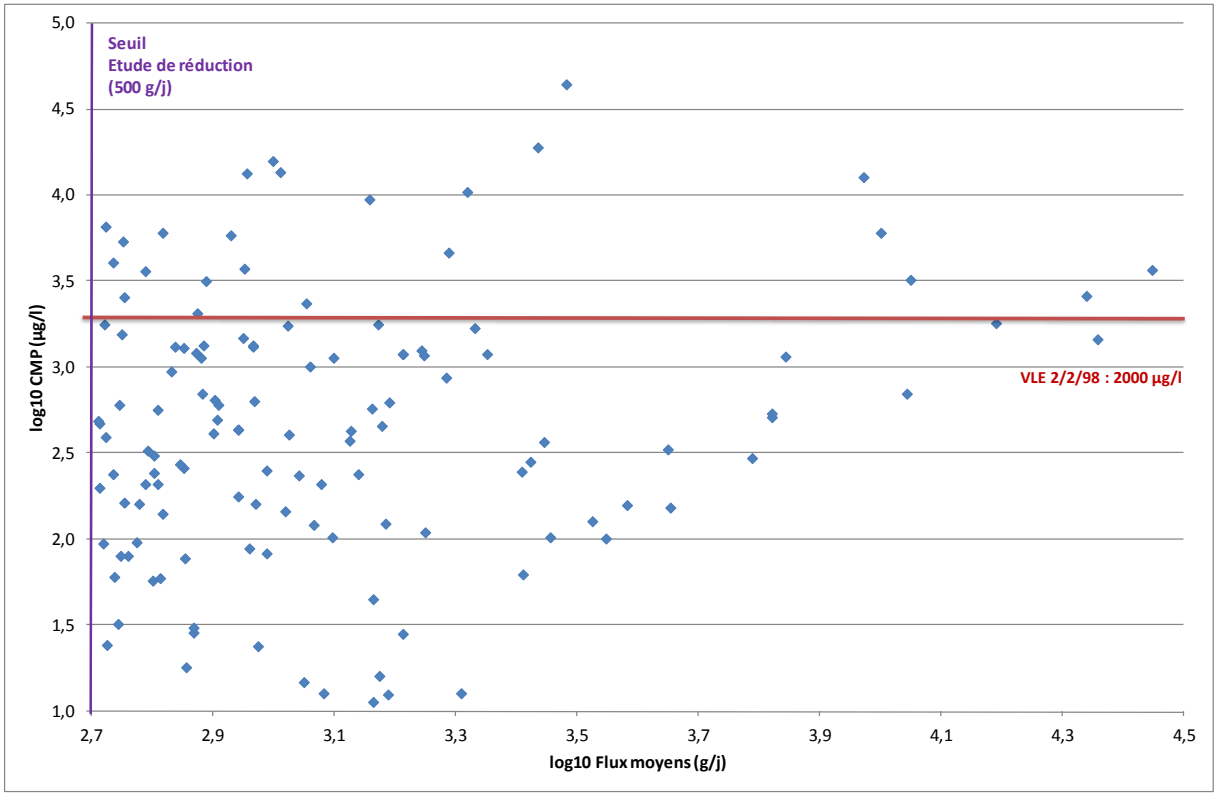


Figure 13: Zinc emission levels at release points exceeding the reduction study thresholds (weighted average concentrations according to average flows)

The emission levels are between:

- Average flow: ≈ 500 to ≈ 28,000 g/d
- WAC: ≈ 11 to ≈ 44,000 µg/l

47 sites represent approximately 80% of the total flows emitted by the 121 sites exceeding the reduction study thresholds (i.e. slightly more than one third of the sites).

[82] Note that the number of sites and the number of release points exceeding the reduction study threshold are different because some sites have several release points (see section 3.4).

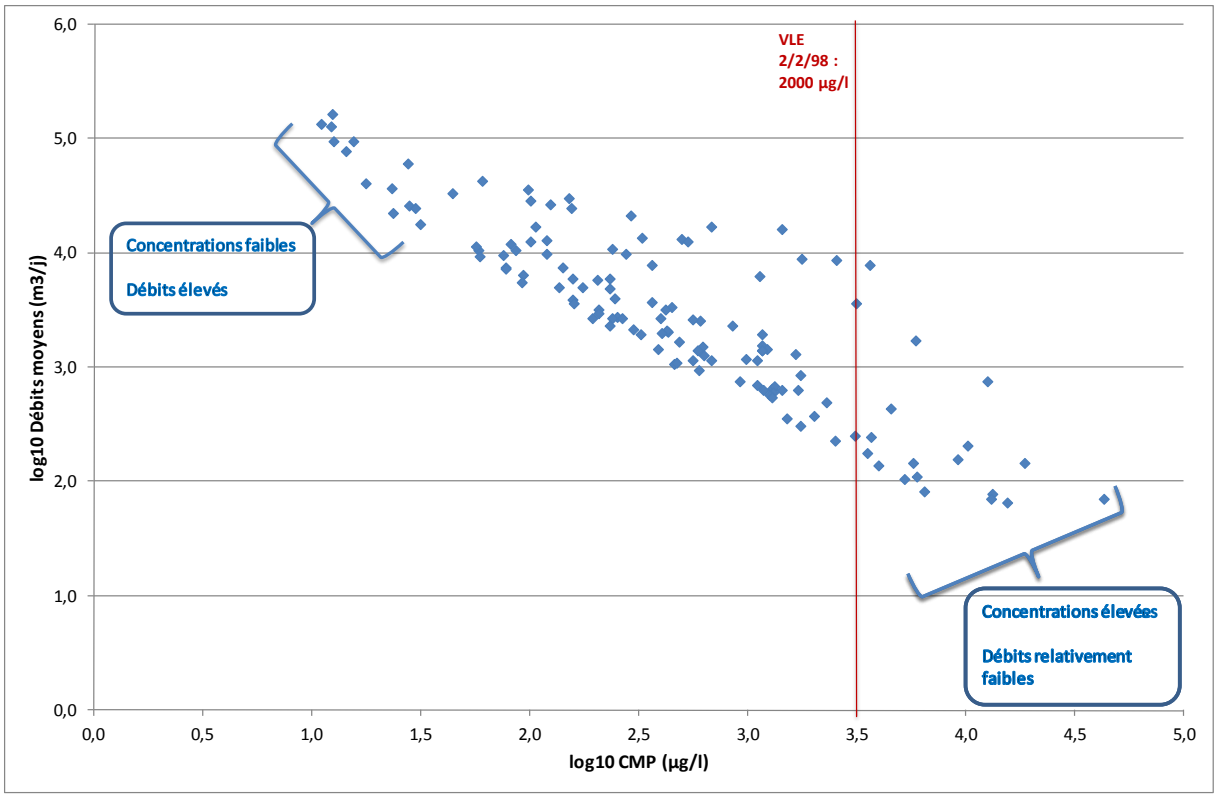


Figure 14: Zinc emission levels at release points exceeding the reduction study thresholds (average flows according to weighted average concentrations)

	< 10 EQS (31 µg/l)	< ELV AM 02/02/98 (2000 µg/l if flows > 20 g/d)	> ELV AM 02/02/98 (2000 µg/l if flows > 20 g/d)
Out of 129 release points(1)	12 (9%)	105	24 (19%)
Average flow rates (m^3/d)	20,000 - 164,000		< 2,000 except 3 sites at ≈ 3,500, 7,700 and 8,500

(1) out of 121 sites

In sectors where zinc is released with significant flows, it may have different "types" of origin or use:

- substances from "incoming" materials: paper mills (zinc contained in biomass), the agri-food industry (products of plant origin), slaughterhouses: animal feed, etc.
- substances from the raw materials used: mechanical working of metals industry, metallurgy, etc.
- substances used in the process: surface treatment, chemicals, etc.
- widespread origins: industrial equipment, roofing, cladding - facades, gutters and generic uses such as: "lubricants", "soaps", etc.
- ...

There is a platform effect for the chemicals sector (some release points are internal to the platforms and do not discharge directly into the environment) but this is actually quite weak. Indeed, about a third of the sites (8 points out of the 23 sampling points of the chemical sector subject to reduction actions) are internal points on platforms[83], but they represent only 13 kg/day out of 109 kg/d (about 10 to 15% only). However, all the platform releases into the environment were not entered in the database when validating the data selected for the analysis.

The main uses or sources of zinc emissions, certain identified means of action or opportunities for action, and the regulatory status are summarised below.

Main industrial uses	Many areas of use: - surface treatment: galvanising steel (depositing a thin layer of zinc on the surface of the steel to protect it from corrosion): consumes 47% of the zinc used worldwide; use of zinc in some processes, zinc releases via stripping of certain parts - metallurgy: manufacture of brass - alloy of copper and zinc - and bronze - alloy of copper and tin, to which zinc is sometimes added: consumes 22% of the zinc used worldwide - construction: roof and cladding (facade) - automobile, household appliances, consumer goods, industrial equipment - chemical industry (catalysts, etc.), paints, rubber, plastics, dyes, wood preservatives, pharmaceuticals and cosmetics. - zinc contained in certain chemical products used in treatments in cooling towers or other equipment (anti-corrosive products in particular).
Other uses or sources of emissions	Zinc is found in both channelled and diffuse releases (urban, agricultural, etc.). Agricultural: - Only 2 zinc compounds are authorised for phytosanitary use (rodenticide and fungicide). - Found in fertilisers. - Animal feed. Other diffuse emissions: - corrosion of roofs, gutters, pipes, etc. (at the industrial and urban levels) - corrosion of industrial equipment (pipes, tanks, etc.) - road traffic (tire wear) etc.
Regulatory status	- Regulatory strengthening is expected on zinc releases for certain sectors via the BREFs (see Appendix 9). - On the other hand, few actions are expected on zinc compounds under the REACH[84] framework in the foreseeable future (few zinc compounds have been classified as SVHC).
Links / Resources	INERIS technical and economic data sheet (2015)

[83] These are, however, different legal entities between the operators of the chemical production facilities and operators of the water treatment plant sharing the platform.

[84] Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18 December 2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals and establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No. 793/93 and Commission Regulation (EC) No. 1488/94 and Council Directive 76/769/EEC and Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC of the Commission.

3.1.2 COPPER

Status of the substance	Specific pollutant of the ecological status (WFD)
EQS	1.4 µg/l

Copper is frequently quantified overall (80% of the sites have quantified copper at least 3 times in their releases) and by all sectors (the 33 sectors, having tested for it and having more than 10 sites, have quantification frequencies from 30% to 100% - several sectors at 100%).

The following graph shows the emission levels of all the points of release from which copper was tested for.

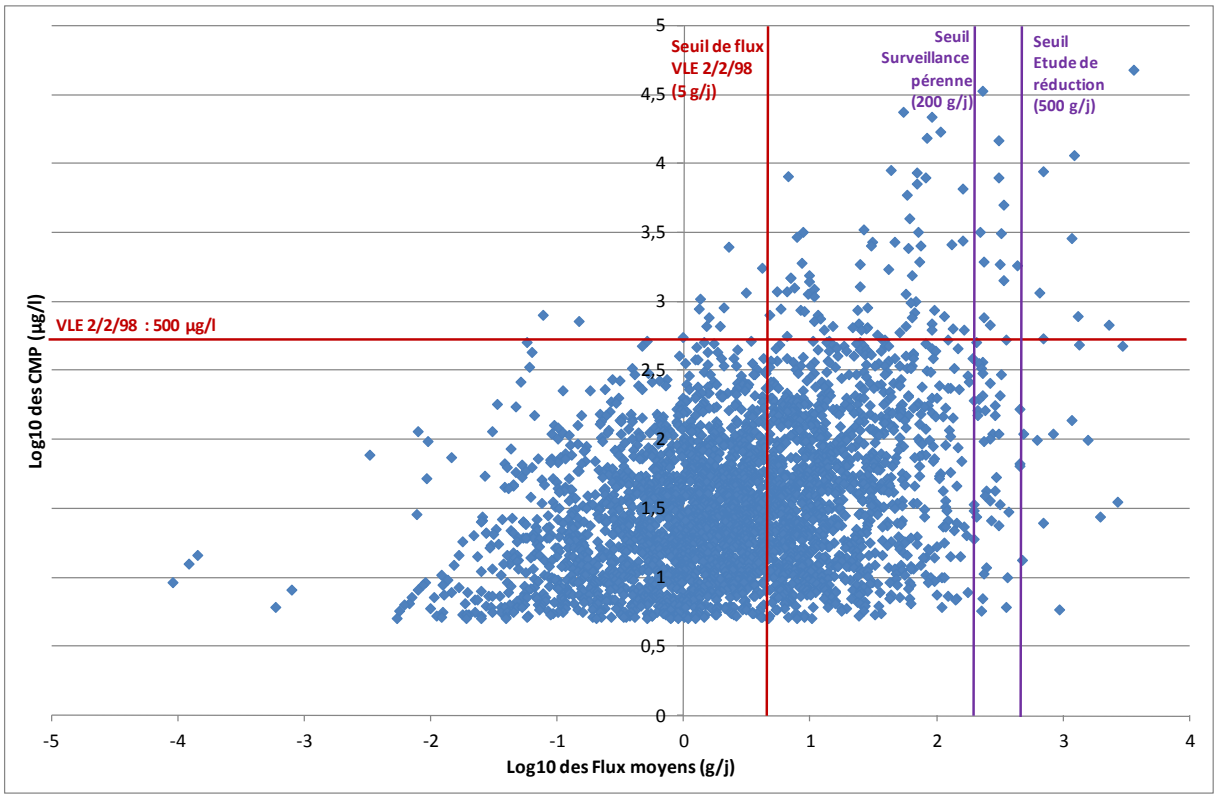


Figure 15: Copper emission levels at all release points (weighted average concentrations according to average flows)

It helps to shed light on release levels as a whole:

	< ELV AM 02/02/98 (500 µg/l if flows > 5 g/d)	> 10 EQS (14 µg/l)	> ELV AM 02/02/98[85] (500 µg/l if flows > 5 g/d)
Out of 4,102 release points[(1)]	4005 (98%)	2318 (58%)	97 (2%)
Whose flow > reduction study threshold	10	17	8
Whose flow < reduction study threshold	3995	2301	89

(1) (out of 3,575 sites)

[85] Although this ELV is not applicable to all sites, the comparison to this value makes it possible to situate all the releases in relation to a “reference” value.

Around 80% of the total flow is discharged by 11 sectors, including 3 sectors that contribute individually to more than 10% of the total flow (the agri-food industry (products of plant origin), chemicals, paper/ cardboard manufacturing at 31%, 21% and 19%, respectively).

Of the 3,575 sites that tested for copper, 71 sites exceeded the long-term monitoring threshold, 23 of which also exceeded the reduction study threshold[86]. These 23 sites represent 40% of the total flow.

262 sites (7%) represent approximately 80% of the total flows emitted.

Focus on sites that exceed the reduction study thresholds:

The following graph shows the emission levels at the release points exceeding the reduction study thresholds:

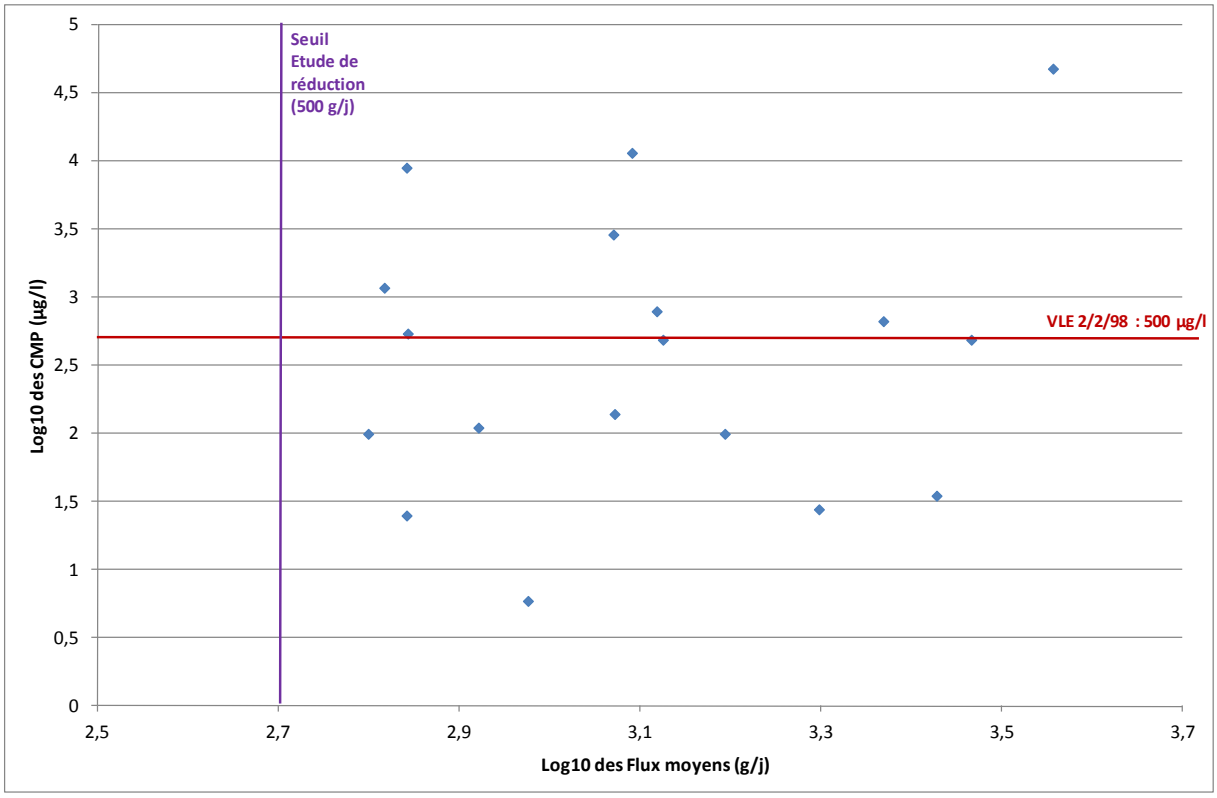


Figure 16: Copper emission levels at release points exceeding the reduction study thresholds (weighted average concentrations according to average flows)

The emission levels are between:

- Average flow: ≈ 500 to ≈ 3,600 g/d
- WAC: ≈ 6 µg/l to 47,000 µg/l

14 sites represent approximately 80% of the total flows emitted by the 23 sites exceeding the reduction study thresholds.

Like zinc, copper emissions are linked to many uses and can also come partly from infrastructure. As regards sites with significant releases, the findings regarding the origin of copper releases are also similar: they can come from raw materials, be used in processes, etc.

Main industrial uses	Many areas of use:

[86] Note that the number of sites and the number of release points exceeding the reduction study threshold are different because some sites have several release points (see section 3.4).

	- electrical and electronic applications, communications, etc. - industry, metallurgy, surface treatment, mechanical metal working, etc. - construction sector, transport (manufacture of vehicles, etc.), consumer goods, industrial equipment (pipes, tanks, etc.), etc. - wood treatment.
Other uses or sources of emissions	Agriculture: - fungicide in the agricultural sector (such as “Bordeaux mixture” for fruit trees) - animal feed (dietary supplement: cattle, pigs, poultry, etc.) Other diffuse emissions: - corrosion of pipes, at the industrial and urban levels (such as drinking water supply, heating, etc.) - corrosion of industrial equipment
Regulatory status	The diversity of regulatory frameworks applicable to copper reflects the number of applications of the substance. In particular, there are regulations on its uses in the agricultural sector (fungicide and animal feed). Prohibited substance in biocides (substance on the non-inclusion list in Appendix I or IA of Directive 98/8/EC[87] that allows the use of substances in biocidal products). Regulatory strengthening is expected on copper releases for certain sectors via the BREFs (see Appendix 9).
Links / Resources	INERIS technical and economic data sheet (2015)

[87] Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market.

3.1.3 NICKEL

Status of the substance	Priority substance (WFD)
EQS	4 µg/l

Overall, 52% of the sites that tested for nickel quantified it at least 3 times in their releases.

For all the sectors that tested for it (and with more than 10 sites), that is, 31 sectors, more than 10% of sites quantified nickel at least 3 times in their releases. Of these, 87% of the sites in the surface treatment sector are involved, and between 70% and 80% of the sites in the hides and skins processing, tank washing, and grouping, pre-treatment or treatment of hazardous waste sectors.

The following Figure 17 shows the emission levels of all the points of release from which nickel was tested for.

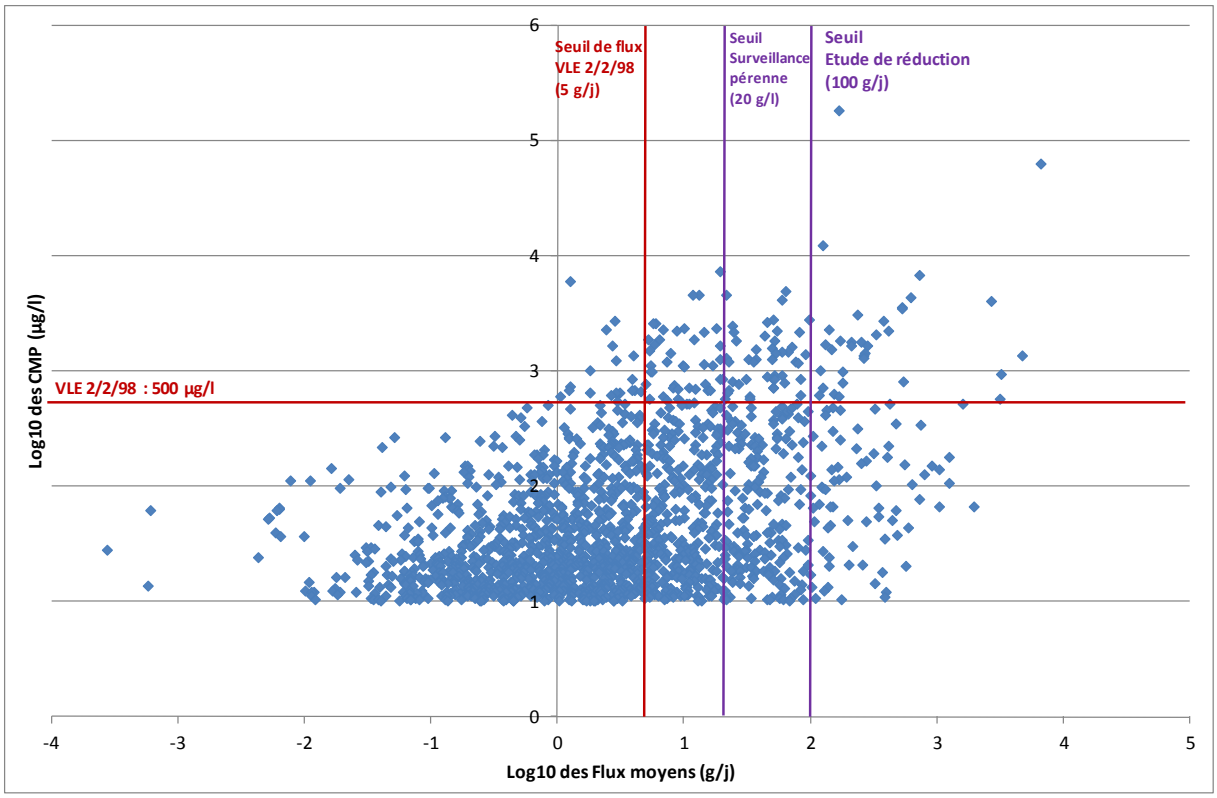


Figure 17: Nickel emission levels at all release points (weighted average concentrations according to average flows)

It helps to shed light on release levels as a whole:

	< ELV AM 02/02/98 (500 µg/l if flows > 5 g/d)	> 10 EQS (40 µg/l)	> ELV AM 02/02/98[88] (500 µg/l if flows > 5 g/d)
Out of 4,061 release points[(1)]	3932 (97%)	751 (18%)	129 (3%)
Whose flow > reduction study threshold	71	89	36
Whose flow < reduction study threshold	3861	662	93

(1) (out of 3,539 sites)

About 80% of the total flow is discharged by 5 sectors: chemicals, surface treatment, the agri-food industry (products of plant origin), the steel industry and non-ferrous metal production/ processing, with each of these sectors individually contributing to more than 10% of the total flow (24%, 17%, 14%, 12% and 11%, respectively).

Of the 3,539 sites that tested for nickel, 303 sites exceeded the long-term monitoring threshold, 99 of which also exceeded the reduction study threshold[89]. These 99 sites represent 81% of the total flow.

Focus on sites that exceed the reduction study thresholds:

The following graph shows the emission levels at the release points exceeding the reduction study thresholds:

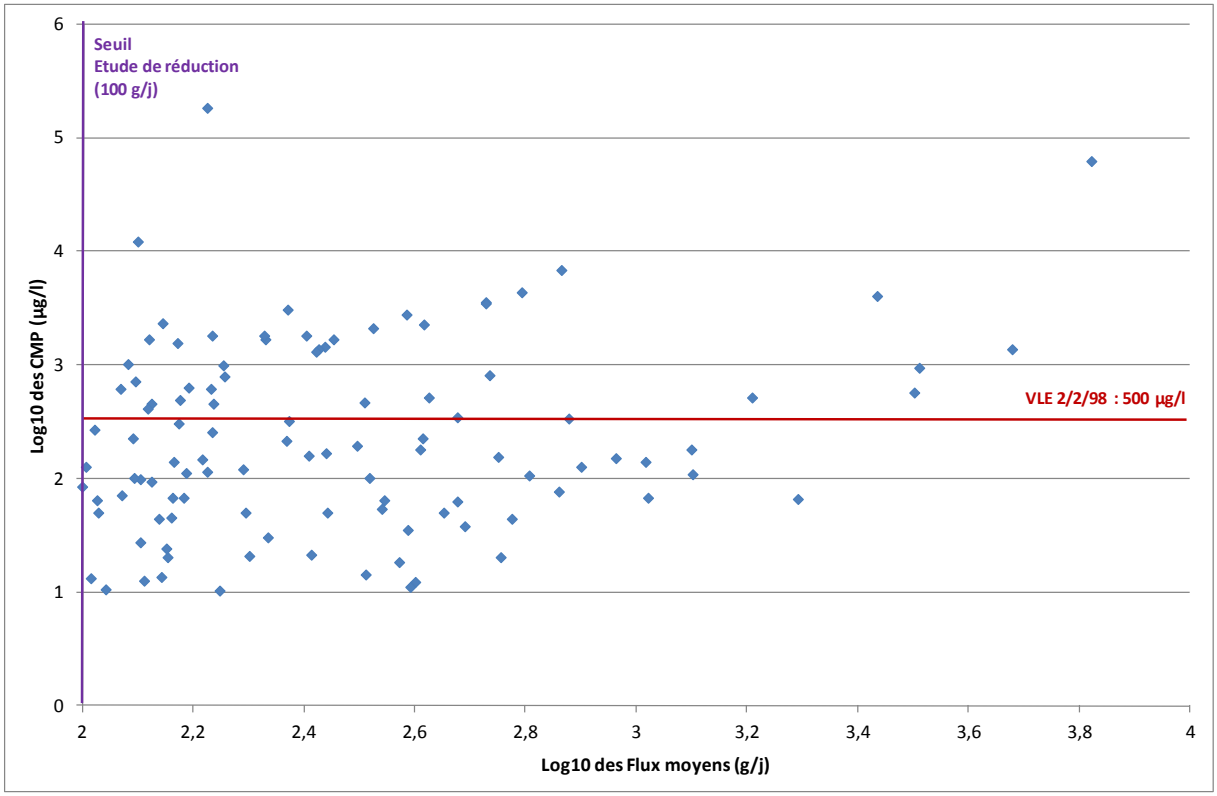


Figure 18: Nickel emission levels at release points exceeding the reduction study thresholds (weighted average concentrations according to average flows)

[88] Although this ELV is not applicable to all sites, the comparison to this value makes it possible to situate all the releases in relation to a "reference" value.

[89] Note that the number of sites and the number of release points exceeding the reduction study threshold are different because some sites have several release points (see section 3.4).

The emission levels are between:

- Average flow: ≈ 100 to ≈ 6,700 g/d
- WAC: ≈ 10 µg/l to 183,000 µg/l

39 sites represent approximately 80% of the total flows emitted by the 99 sites exceeding the reduction study thresholds (i.e. slightly more than one third of the sites).

Nickel can have different “types” of origin or use:

- substances from the raw materials used: metallurgy, etc.
- substances used in the process: surface treatment, etc.
- ...

The main contributing site, registered in the non-ferrous metal production/ processing sector, is an industrial metal waste treatment plant.

Main industrial uses	- Several applications in the form of alloys with other components: stainless steels - used in many sectors (such as industrial equipment, building and construction, transport, etc.); nickel alloys; surface treatment, nickel plating - also involved in many sectors and uses; alloy steels and foundry; batteries; change (money), etc.
Other uses or sources of emissions	- Agriculture: nickel is present in synthetic fertilisers (diffuse emissions).
Regulatory status	- Use is prohibited in jewellery alloys under the REACH framework. - Regulatory strengthening is expected on nickel releases for certain sectors via the BREFs (see Appendix 9).
Links / Resources	- INERIS technical and economic data sheet (2015) - Appendix XVII REACH, ECHA documents and website

3.1.4 CHROMIUM

Status of the substance	Specific pollutant of the ecological status (WFD)
EQS	3.4 µg/l

Overall, 62% of the sites that tested for chromium quantified it at least 3 times in their releases.

For all the sectors that tested for it (and with more than 10 sites), that is, 31 sectors, more than 10% of sites quantified chromium at least 3 times in their releases. Of these, more than 70% of the sites in the following sectors are affected: processing of hides and skins, plum drying, finishing, commercial laundry, household waste incineration plants, non-hazardous waste storage facilities, surface treatment.

The following graph shows the emission levels of all the points of release from which chromium was tested for.

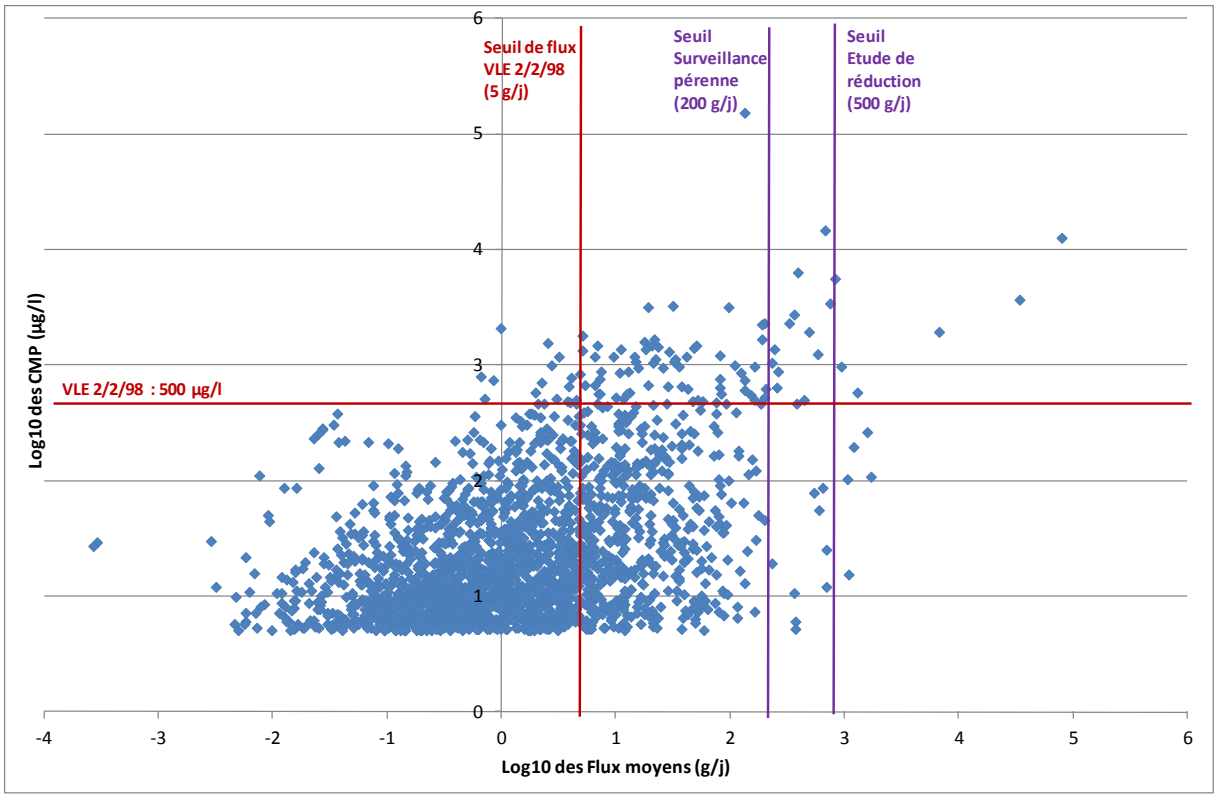


Figure 19: Chromium emission levels at all release points (weighted average concentrations according to average flows)

It helps to shed light on release levels as a whole:

	< ELV AM 02/02/98 (500 µg/l if flows > 5 g/d)	> 10 EQS (> 34 µg/l)	> ELV AM 02/02/98[90] (500 µg/l if flows > 5 g/d)
Out of 3,826 release points[(1)] (out of 3,333 sites)	3750 (98 %)	652 (17 %)	76 (2 %)
Whose flow > reduction study threshold	10	16	9
Whose flow < reduction study threshold	3740	636	67

[(1)] (out of 3,333 sites)

2 sites represent 73% of the total flow. As a result of these main contributing sites, the sectors to which they belong (production/ processing of non-ferrous metals and pigment manufacturing) also appear as major contributors (at 51% and 22% of the total flow respectively). The activity of these sites consists of the production of non-ferrous metals and the manufacture of titanium dioxide.

Other contributing sectors are: the agri-food industry (products of plant origin), hides and skins processing, chemicals, the steel industry, surface treatment, non-hazardous waste storage facilities.

Of the 3,333 sites that tested for chromium, 38 sites exceeded the long-term monitoring threshold, 19 of which also exceeded the reduction study threshold[91]. These 19 sites represent 86% of the total flow.

[90] Although this ELV is not applicable to all sites, the comparison to this value makes it possible to situate all the releases in relation to a “reference” value.

[91] Note that the number of sites and the number of release points exceeding the reduction study threshold are different because some sites have several release points (see section 3.4).

Focus on sites that exceed the reduction study thresholds:

The following graph shows the emission levels at the release points exceeding the reduction study thresholds:

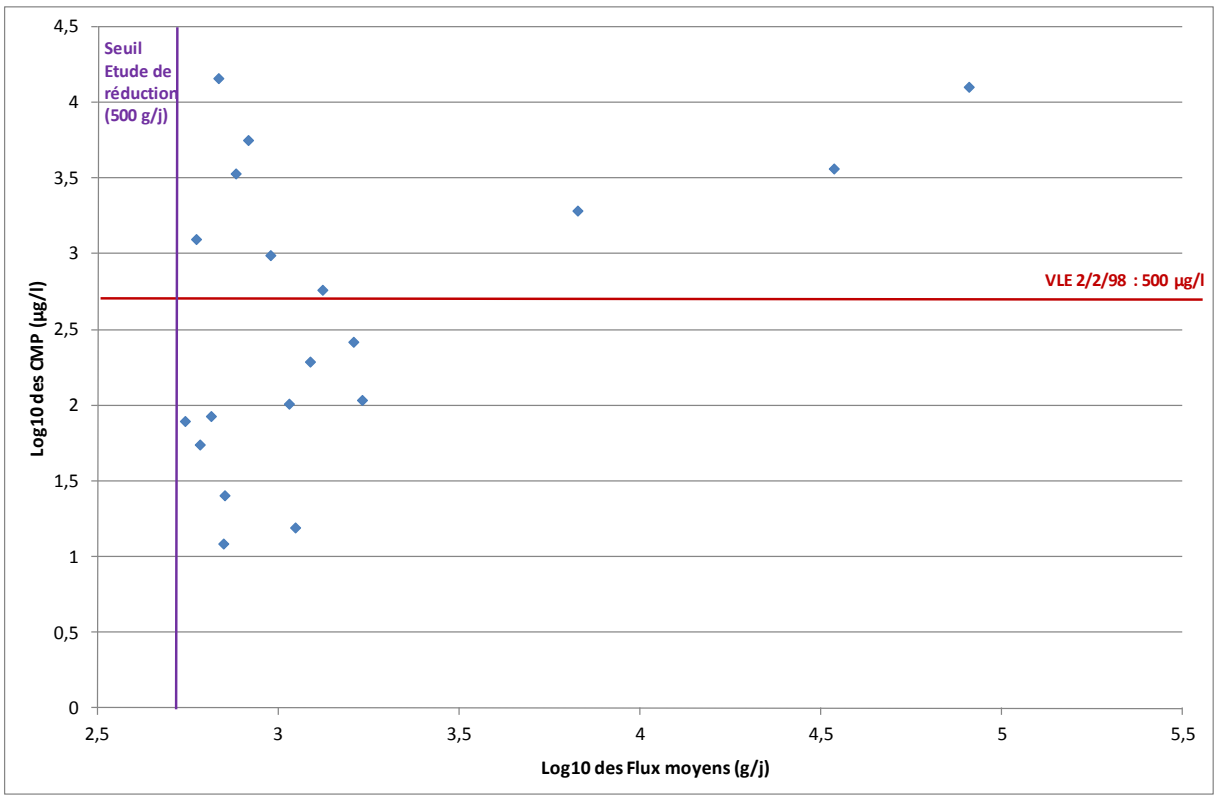


Figure 20: Chromium emission levels at release points exceeding the reduction study thresholds (weighted average concentrations according to average flows)

The emission levels are between:

- Average flow: ≈ 500 g/d to 81,300 g/d
- WAC: ≈ 12 µg/l to 14,400 µg/l

Chromium can have different “types” of origin or use:

- substances from the raw materials used: metallurgy, etc.
- substance used in the process: manufacture of pigments, processing of hides and skins, surface treatment, etc.
- ...

Main industrial uses	- Various industrial applications. Used in metallurgy (alloys, production of stainless steels, refractories, etc.), chemicals, surface treatment of metals and plastics, pigment manufacturing, leather tanning, wood preservation, etc.
Other uses or sources of emissions	- Agriculture: Chromium is also present in synthetic phosphatic fertilisers as an impurity (diffuse emissions).
Regulatory status	- Partially prohibited in the treatment of wood. (EU)REACH: - Cr VI and Cr III compounds have been included in the list of SVHCs or candidate list of substances for authorisation (chromic acid entered in 2010 for its carcinogenic properties). - The acids generated from chromium trioxide (chromic acid, dichromic acid and their oligomers) are listed in Annex XIV. - Prohibition of Cr VI for cement (greater than 2 mg/kg, 0.0002% m/m), in articles containing leather parts in contact with the skin at concentrations of 3 mg/kg or greater (0.0003% m/m). - The ban in tanning salts and tanning products is applicable to European products and imports. - Regulatory strenghtening is expected on chromium releases for certain sectors via the BREFs (see Appendix 9).
Links / Resources	- INERIS technical and economic data sheet (2015) - Annex XVII REACH, ECHA website and documents

3.1.5 ARSENIC

Status of the substance	Specific pollutant of the ecological status (WFD)
EQS	4.2 µg/l

Overall, 26% of the sites that tested for arsenic quantified it at least 3 times in their releases.

For 21 sectors (among the 25 sectors that tested for it and with more than 10 sites), more than 10% of sites quantified arsenic at least 3 times in their releases. Of these, 70% of sites in the non-hazardous waste storage facilities sector are concerned.

The following graph shows the emission levels of all the points of release from which arsenic was tested for.

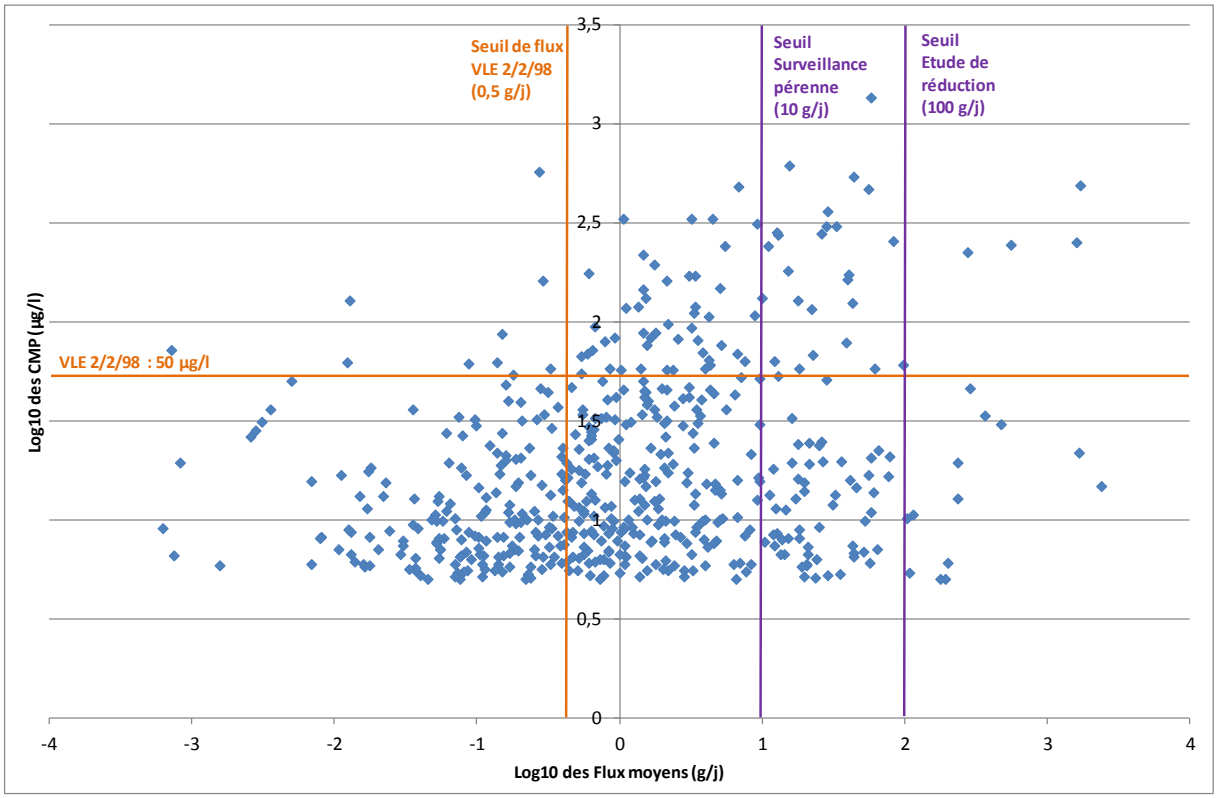


Figure 21: Arsenic emission levels at all release points (weighted average concentrations according to average flows)

It helps to shed light on release levels as a whole:

	< ELV AM 02/02/98 (50 µg/l if flows > 0.5 g/d)	> 10 EQS (42 µg/l)	> ELV AM 02/02/98[92] (50 µg/l if flows > 0.5 g/d)
Out of 2,310 release points[(1)]	2229 (96%)	106 (5 %)	81 (4%)
Whose flow > reduction study threshold	13	5	4
Whose flow < reduction study threshold	2216	101	77

[(1)] out of 1,986 sites.

About 80% of the total flow is discharged by 5 sectors: the agri-food industry (products of plant origin), oil depots/ terminals, chemicals, refineries and non-ferrous metal production/ processing, with each of these sectors individually contributing to more than 10% of the total flow (18%, 18%, 18%, 15% and 12%, respectively).

Of the 1,986 sites that tested for arsenic, 89 sites exceeded the long-term monitoring threshold, 14 of which also exceeded the reduction study threshold[93]. These 14 sites represent 78% of the total flow.

[92] This ELV is not specific to arsenic. It is one of the substances referred to in section 15 of paragraph 3 of article 32 for which an emission limit value is set for the facility's release point, for the final release and in cumulated flows and concentrations. It is included in Appendix V a of the Ministerial Order of 02/02/1998: Very toxic substances for the aquatic environment (ELV: 0.05 mg/L if the release exceeds 0.5 g/d). Although this ELV is not applicable to all sites, the comparison to this value makes it possible to situate all the releases in relation to a "reference" value.

[93] Note that the number of sites and the number of release points exceeding the reduction study threshold are different because some sites have several release points (see section 3.4).

Focus on sites that exceed the reduction study thresholds:

The following graph shows the emission levels at the release points exceeding the reduction study thresholds:

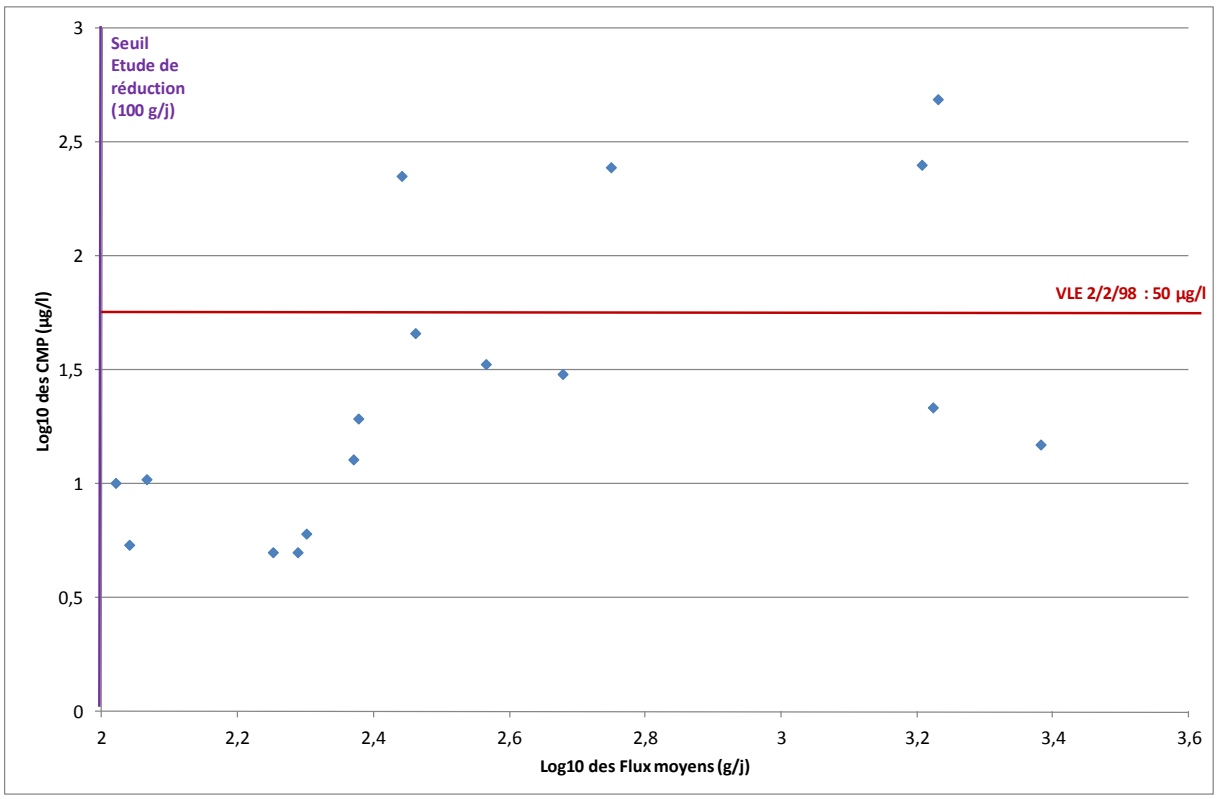


Figure 22: Arsenic emission levels at release points exceeding the reduction study thresholds (weighted average concentrations according to average flows)

The emission levels are between:

- Average flow: ≈ 100 g/d to 2,400 g/d
- WAC: ≈ 5 µg/l to 483 µg/l

6 sites represent approximately 80% of the total flows emitted by the 14 sites exceeding the reduction study thresholds.

Main industrial uses	Several applications: - wood treatment (with many restrictions); - lead-antimony-arsenic alloy used in electric batteries; - semi-conductors (gallium arsenide GaAs); - various electrical and electronic equipment (toner, light-emitting diodes, photovoltaic cell elements, electronic charts, etc); - decolorising agent in the glass industry; - paint pigments in combination with copper; - alloys with copper, lead, gold, to increase their hardness; - tanneries; - chemical intermediate, etc.
Other uses or sources of emissions	- Agriculture: pesticides, herbicides
Regulatory status	Annex XVII of REACH establishes a detailed list of the restrictions applicable in terms of the use of arsenic and its compounds. - Prohibited uses: anti-fouling; industrial water treatment, wood treatment products (the treated wood must not be placed on the market as well) except for uses in industrial plants using specific techniques for impregnation. - Uses remain authorised for the protection of wood with the following reserves: - if used in industrial implementation (such as vacuum operated plants); - if used for human or livestock safety (such as gates, avalanche gates, noise barriers, etc.); - apart from any use in buildings; - if contact with the skin is avoided. Arsenic acid and pentaoxides are listed in Annex XIV of REACH (list of substances subject to authorisation). A file “Further arsenic compounds” is mentioned in the Registry of Intentions so that these other arsenic compounds are put into the candidate list as a result of their CMR properties (no date is given for submitting this file).
Links / Resources	- INERIS technical and economic data sheet (2008) - Annex XVII REACH, ECHA documents and website

3.1.6 LEAD

Status of the substance	Priority substance (WFD)
EQS	1.2 µg/l

Overall, 33% of the sites that tested for lead quantified it at least 3 times in their releases.

For 31 sectors (among the 32 sectors that tested for it and with more than 10 sites), more than 10% of sites quantified lead at least 3 times in their releases. Of these, 76% of the sites in the household waste incineration sector are concerned.

The following graph shows the emission levels of all the points of release from which lead was tested for.

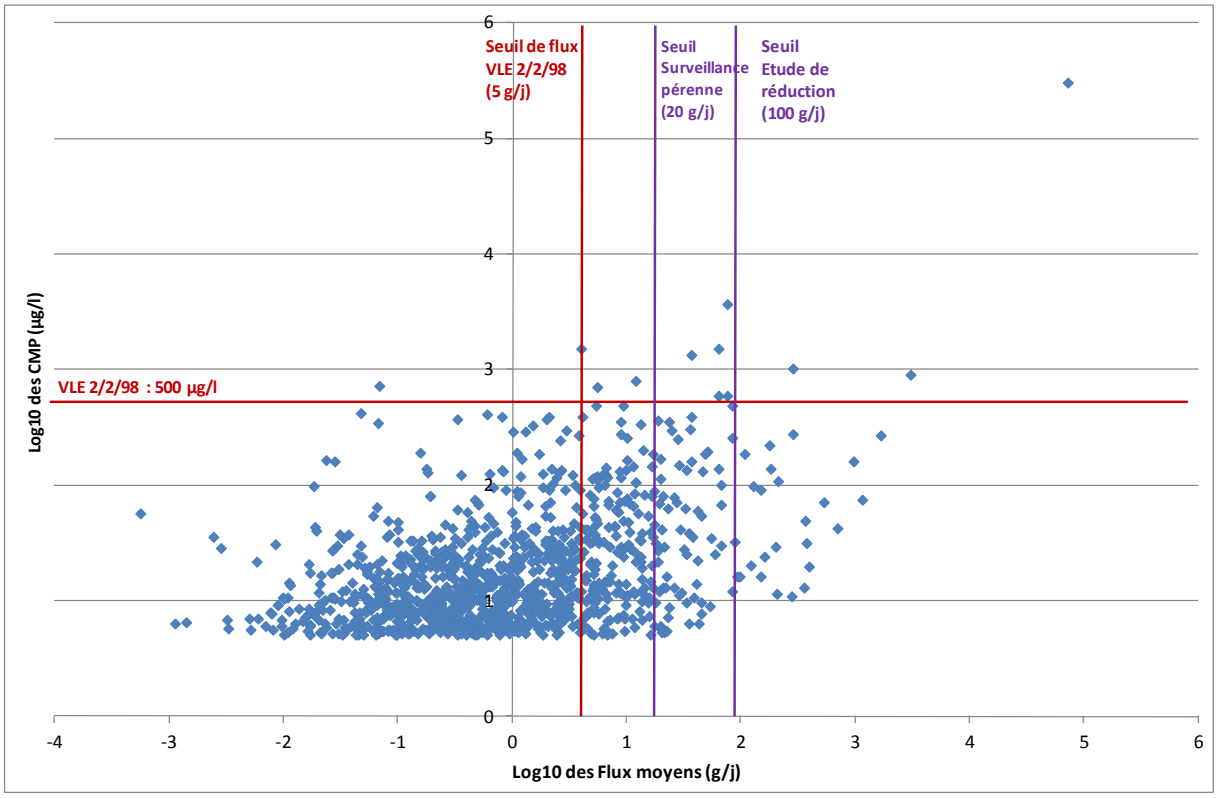


Figure 23: Lead emission levels at all release points (weighted average concentrations according to average flows)

It helps to shed light on release levels as a whole:

	< ELV AM 02/02/98 (500 µg/l if flows > 5 g/d)	> 10 EQS (12 µg/l)	> ELV AM 02/02/98[94] (500 µg/l if flows > 5 g/d)
Out of 3,879 release points[(1)]	3869 (99.7 %)	578 (15 %)	10 (0.3 %)
Whose flow > reduction study threshold	22	23	3
Whose flow < reduction study threshold	3847	555	7

[(1)] (out of 3,394 sites)

1 site (0.03%) represents 81% of the total flow emitted. Because of this main contributing site, the sector to which it belongs (the plastic industry) also appears as the main contributor. This site's activity consists of the recycling of post-industrial and post-consumer waste, in particular battery crushers for the manufacture of plastic (mainly polypropylene).

Other contributing sectors include: the agri-food industry (products of plant origin), non-ferrous metal production/ processing, the steel industry and chemicals (and other sectors to a lesser extent).

Of the 3,394 sites that tested for lead, 86 sites exceeded the long-term monitoring threshold, 25 of which also exceeded the reduction study threshold[95]. These 25 sites represent 95% of the total flow.

[94] Although this ELV is not applicable to all sites, the comparison to this value makes it possible to situate all the releases in relation to a "reference" value.

[95] Note that the number of sites and the number of release points exceeding the reduction study threshold are different because some sites have several release points (see section 3.4).

Focus on sites that exceed the reduction study thresholds:

The following graph shows the emission levels at the release points exceeding the reduction study thresholds:

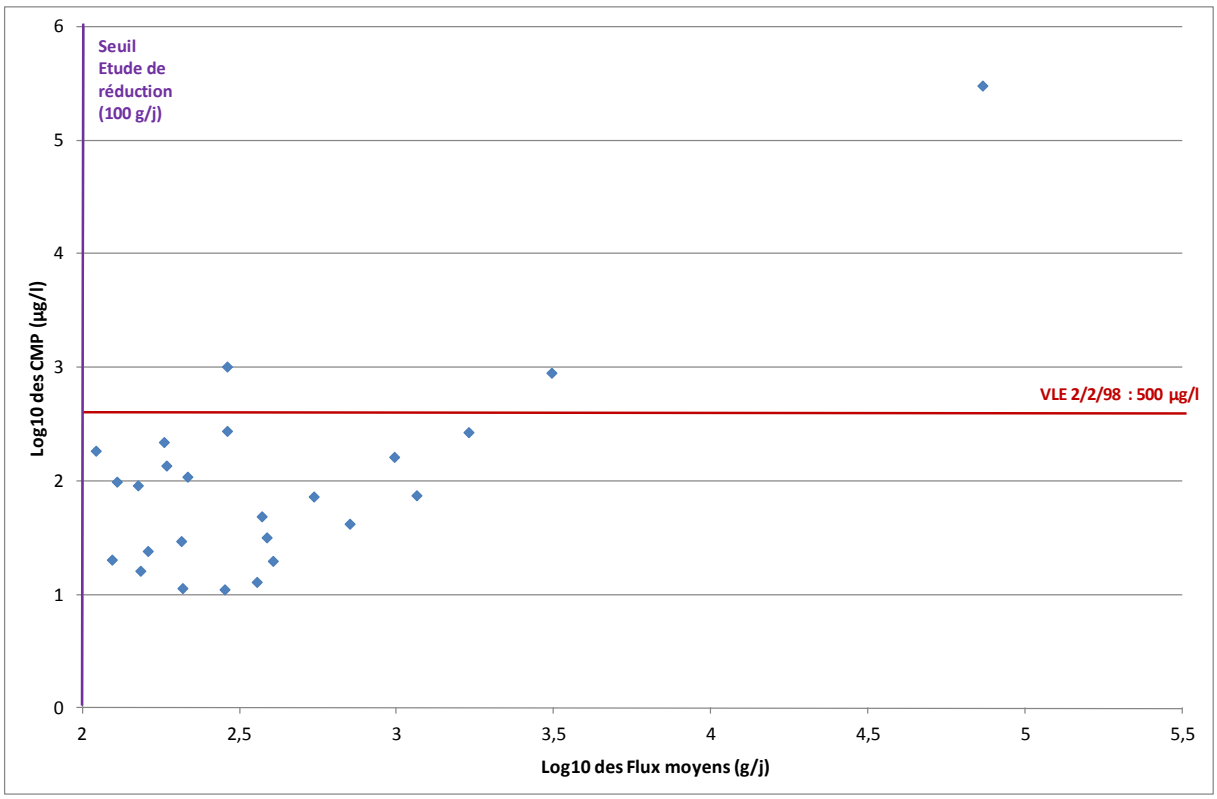


Figure 24: Lead emission levels at release points exceeding the reduction study thresholds (weighted average concentrations according to average flows)

The emission levels are between:

- Average flow: ≈ 100 g/d to 73,800 g/d
- WAC: ≈ 11 µg/l to 300,000 µg/l

Main industrial uses	- Mainly the manufacture of batteries - Manufacture of pigments, sheets and extruded lead products, plastics, ammunition, lead alloys, cable sheaths.
Other uses or sources of emissions	- Declining use, as a result of the tightening of the health/ environment regulation (REACH) - Prohibition in the implementation of drinking water supply pipelines since 1995 (replacement of indoor piping for private individuals). - Prohibition of the placing on the market of paints containing lead since 1995.

Regulatory status	- Several regulations
	Prohibition in road fuels. It has long been replaced by benzene as an anti-knock additive.
	- Restrictions exist for the following uses (Annex XVII):
	  - jewellery containing more than 0.05% m/m lead
	  - articles (produced in the EU or imported) containing more than 0.05% m/m of lead intended for consumers and likely to be put in the mouth by children
	  - paintings containing PbCO3, 2PbCO3-Pb(OH)2, PbSO4 or PbxSO4 should not be placed on the market
	- 3 lead compounds are subject to authorisation and 31 lead compounds are identified as SVHC.
	- The first authorisations requested under the REACH framework concerned lead pigments used to colour paints or objects in special applications (objects and paint used in road/ airport signage or security marking, etc.), and lead chromate for military pyrotechnic devices.
	- Regulatory strengthening is expected on lead releases for certain sectors via the BREFs (see Appendix 9).

Links / Resources	- INERIS technical and economic data sheet (2015) - Annex XVII REACH, ECHA documents and website

3.1.7 CADMIUM

Status of the substance	Priority Hazardous Substance (WFD)
EQS	0.08 µg/l to 0.25 µg/l depending on the hardness of the water

Overall, cadmium is poorly quantified, with 8% of the sites having quantified it at least 3 times in their releases.

The following graph shows the emission levels of all the points of release from which cadmium was tested for.

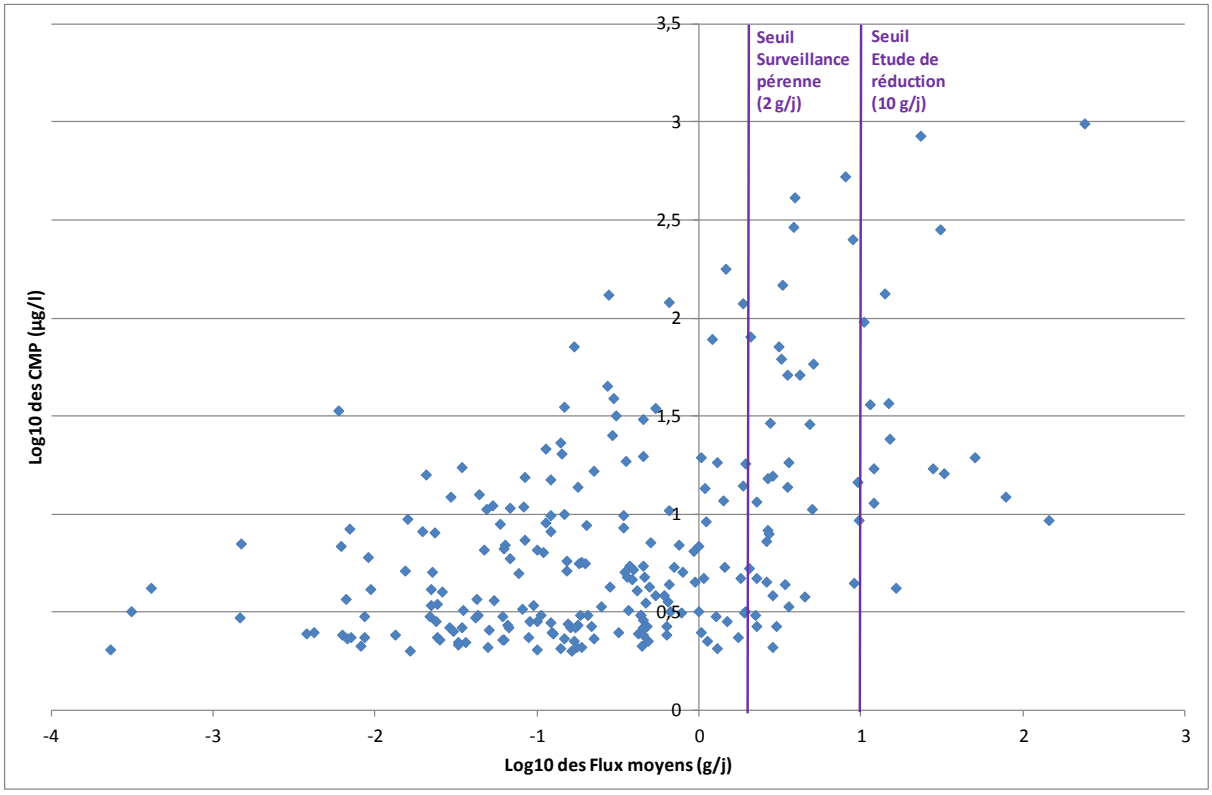


Figure 25: Cadmium emission levels at all release points (weighted average concentrations according to average flows)

About 80% of the total flow is released by 5 sectors: the plastic industry, production/ transformation of non-ferrous metals, the agri-food industry (products of plant origin), grouping/ treatment of hazardous waste and household waste incineration.

The contribution of the first sector (plastics industry) is due almost entirely to a single site (main contributor site), representing 26% of the total flow. This site's activity consists of battery recycling. This same site is the main contributor to lead releases.

Of the 2,867 sites that tested for cadmium, 48 sites exceeded the long-term monitoring threshold, 16 of which also exceeded the reduction study threshold. These 16 sites represent 79% of the total flow.

The cadmium emission levels are between:

- Average flow: ≈ 10 g/d to 243 g/d
- WAC: ≈ 4 µg/l to 985 µg/l

Main industrial uses	- Used in surface treatment for specific applications (such as aeronautics/ space; military). - Used in plastics or paints (when required by safety conditions): declining use. - The use of cadmium persists in batteries for industrial use, although the current trend is to replace it (some Nickel-Cadmium batteries are replaced by a Nickel-Metal hydride combination): declining use.
Other uses or sources of emissions	- Agriculture: cadmium is also present in synthetic phosphatic fertilisers as an impurity (diffuse emissions); European standards have been decreasing the allowable levels in recent years. - Progressive disappearance for uses or applications not specifically dedicated to professionals. - Without being able to specify its significance, the literature indicates that diffuse emissions seem more significant (while remaining of the same order of magnitude) than channelled emissions.
Regulatory status	- Annex XVII of REACH: Prohibited as a stabiliser in a large number of articles (such as plastics), in paints or in applications that may come into contact with the user (such as surface treatment, jewellery, etc.). - The European Commission has taken a step (REACH restriction) to reduce the use of cadmium as an additive in plastics and paints, including for imported articles. - In 2013 and 2014, Sweden submitted dossiers identifying the CMR properties of Cd and its compounds (oxidized, chloride, sulphate, etc.). They were added to the list identifying SVHCs in 2014. - Listed in Annex I of the PIC Regulation (Prior Informed Consent Regulation), severely restricted industrial and professional use. - Regulatory strengthening is expected on cadmium releases for certain sectors, via the BREFs (see Appendix 9).
Links / Resources	- INERIS technical and economic data sheet (2005) - Annex XVII REACH, ECHA documents and website - Information on fertilisers can be found on the European Commission's website

3.1.8 MERCURY

Status of the substance	Priority Hazardous Substance (WFD)
EQS	No water EQS

Overall, mercury is poorly quantified, with 5% of the sites having quantified it at least 3 times in their releases.

The following graph shows the emission levels of all the points of release from which mercury was tested for.

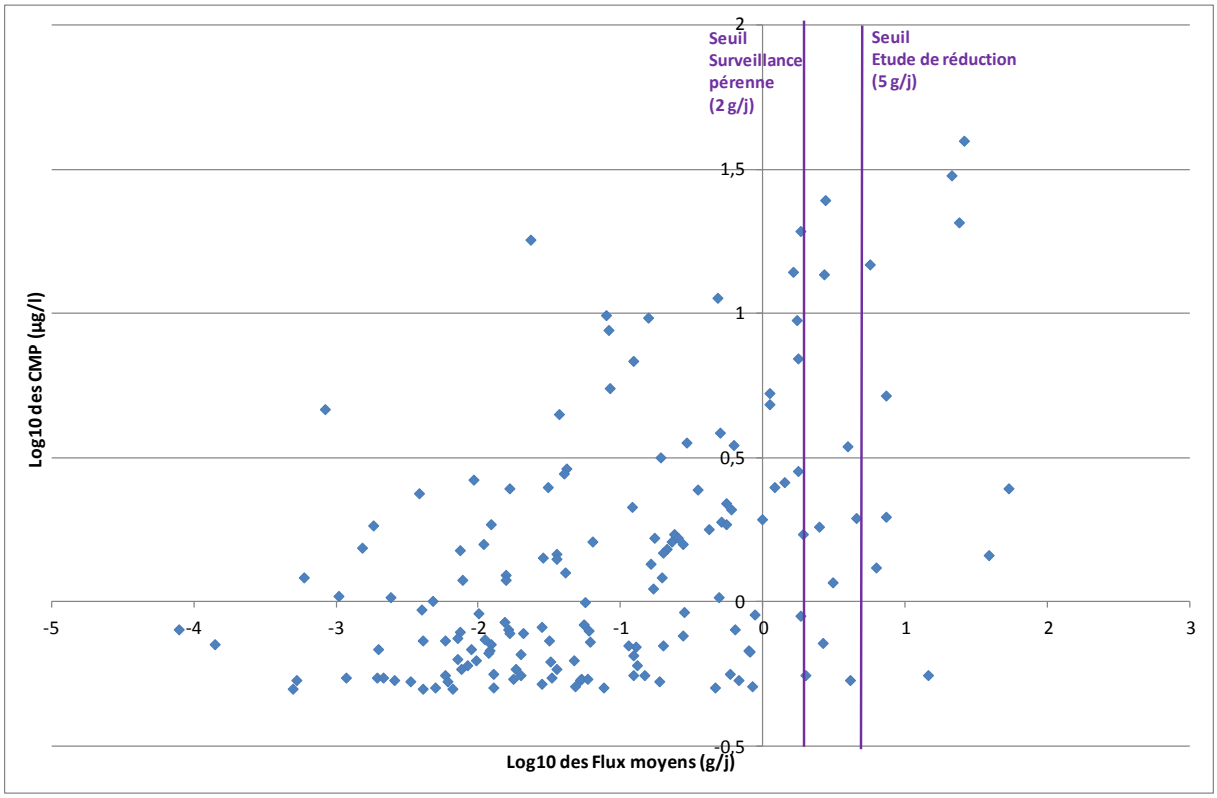


Figure 26: Mercury emission levels at all release points (weighted average concentrations according to average flows)

About 80% of the total flow is discharged by 2 sectors: chemicals (57%) and household waste incineration (23%).

Of the 2,981 sites that tested for mercury, 17 sites exceeded the long-term monitoring threshold, 8 of which also exceeded the reduction study threshold. These 8 sites represent 76% of the total flow.

The mercury emission levels are between:

- Average flow: ≈ 5 g/d to 53 g/d
- WAC: ≈ 0.5 µg/l to 40 µg/l

Main industrial uses	- Industrial use in the chlorine and soda industries. The replacement of mercury cells in France is largely carried out today.
Other uses or sources of emissions	- Dental amalgams - Button cell batteries - Low consumption bulbs
Regulatory status	- Minamata Convention (2013): provides, inter alia, for the prohibition of mercury mining, the setting of progressive prohibition lists (from 2018) or restriction for products containing mercury and processes using this heavy metal, etc. - Restrictions (Annex XVII of REACH): - prohibition on use as anti-fouling, wood preservation product, textile impregnation, industrial water treatment - prohibition of the presence of mercury in thermometers, barometers, etc. - Phenylmercury must not be manufactured or used as a mixture or in articles after 10/10/2017 at concentrations greater than or equal to 0.01% - Study on prohibition (initiated in 2011) in use in dental amalgams and button cell batteries: ongoing research for alternative solutions. - Storage of metallic mercury: Directive 2011/97/EU[96] of 5/12/2011 amending Directive 1999/31/EC as regards the specific criteria for the storage of metallic mercury considered as waste. - Regulatory strenghtening is expected on mercury releases for certain sectors via the BREFs (see Appendix 9).
Links / Resources	- INERIS technical and economic data sheet (2008) - Annex XVII REACH, ECHA documents and website - European Commission website: communications on the uses and dangers of mercury and the Community strategy on mercury.

[96] Directive 2011/97/EU of the Council amending Directive 1999/31/EC as regards the specific criteria for the storage of metallic mercury considered as waste.

3.2 HALOGENATED VOLATILE ORGANIC COMPOUNDS (HVOC)

18 HVOCs were tested for as part of the RSDE2 action.

The family of HVOCs represents 10% of analyses (3rd most tested for family).

Of these 18 HVOCs, 9 HVOCs were only tested for in the chemical sector (not included in the sector-specific lists of other sectors)[97] and 4 HVOCs were only tested for in 2 sectors[98]. The 5 most tested for HVOCs (in at least 10 sectors) are chloroform, trichlorethylene (perchlorethylene), tetrachlorethylene, methylene chloride (dichloromethane) and carbon tetrachloride.

Overall, approximately 18% of the analyses result in a quantified result. HVOCs are overall poorly quantified (except for chloroform, which was quantified at least 3 times by 44% of the sites). Tetrachlorethylene, methylene chloride, trichlorethylene and carbon tetrachloride were quantified at least 3 times by 12%, 11%, 7% and 2% of the sites, respectively.

117 reduction studies (about 20% of the reduction studies) focus on HVOCs, which is the second most affected family of substances in reduction studies after metals. For long-term monitoring, it is the third most concerned family after metals and alkylphenols.

Of these 18 HVOCs, chloroform is most frequently quantified and is the substance most affected by reduction studies. It is the subject of a detailed analysis below.

HVOCs are governed by ministerial orders regulating classified facilities. Emission limit values in concentration and specific flow are set in the Ministerial Order of 2 February 1998 (Article 32-4) for 6 HVOCs (chloroform, trichlorethylene, tetrachlorethylene, carbon tetrachloride, 1,2-dichloroethane and hexachlorobutadiene). These limit values specifically target the production of these substances, or their use in specific cases, and constitute reference values for other industrial sectors. Methylene chloride (dichloromethane) is included in Appendix Vb of this Order[99].

1 HVOC tested for in the RSDE2 framework, vinyl chloride monomer, is also targeted in the BREF POL (polymer manufacturing) (in specific flow, per tonne of product, PVC in emulsion).

[97] The HVOCs only tested for in the chemical sector: 1,1-dichloroethane, 1,1-dichloroethylene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, 3-chloroprene (allyl chloride), chloroprene, vinyl chloride and hexachloroethane.

[98] The following HVOCs were only tested for in 2 sectors, namely the chemical sector and the sector specified below in parentheses for each HVOC: 1,2 dichloroethane (sector 3.4 Washing of cisterns); 1,2 dichloroethylene (sector 2.4 Petroleum industries: sites for the synthesis or transformation of petroleum products (excluding petrochemicals)); hexachlorobutadiene (sector 3.5 Other non-hazardous waste treatment sites) and hexachloropentadiene (sector 2.3 Petroleum industries: petroleum product blending and packaging sites).

[99] Substances referred to in section 15 of paragraph 3 of Article 32 for which an emission limit value is set for the facility's release point, for the final release and in cumulated flows and concentrations (non-specific ELV for these substances); Appendix V b: Long-term toxic or harmful substances for the aquatic environment (ELV: 1.5 mg/L if the release exceeds 1 g/d).

3.2.1 CHLOROFORM

Status of the substance	Priority substance (WFD)
EQS	2.5 µg/l

Overall, 44% of the sites that tested for chloroform quantified it at least 3 times in their releases.

For 24 sectors (out of 31 sectors that tested for it and with more than 10 sites), more than 10% of sites quantified chloroform at least 3 times in their releases. Of these, 87% of sites in the commercial laundry sector are concerned, and between 50 and 80% of sites for the pharmacy, agri-food industry (products of plant origin), chemical and refineries sectors.

The following graph shows the emission levels of all the points of release from which chloroform was tested for.

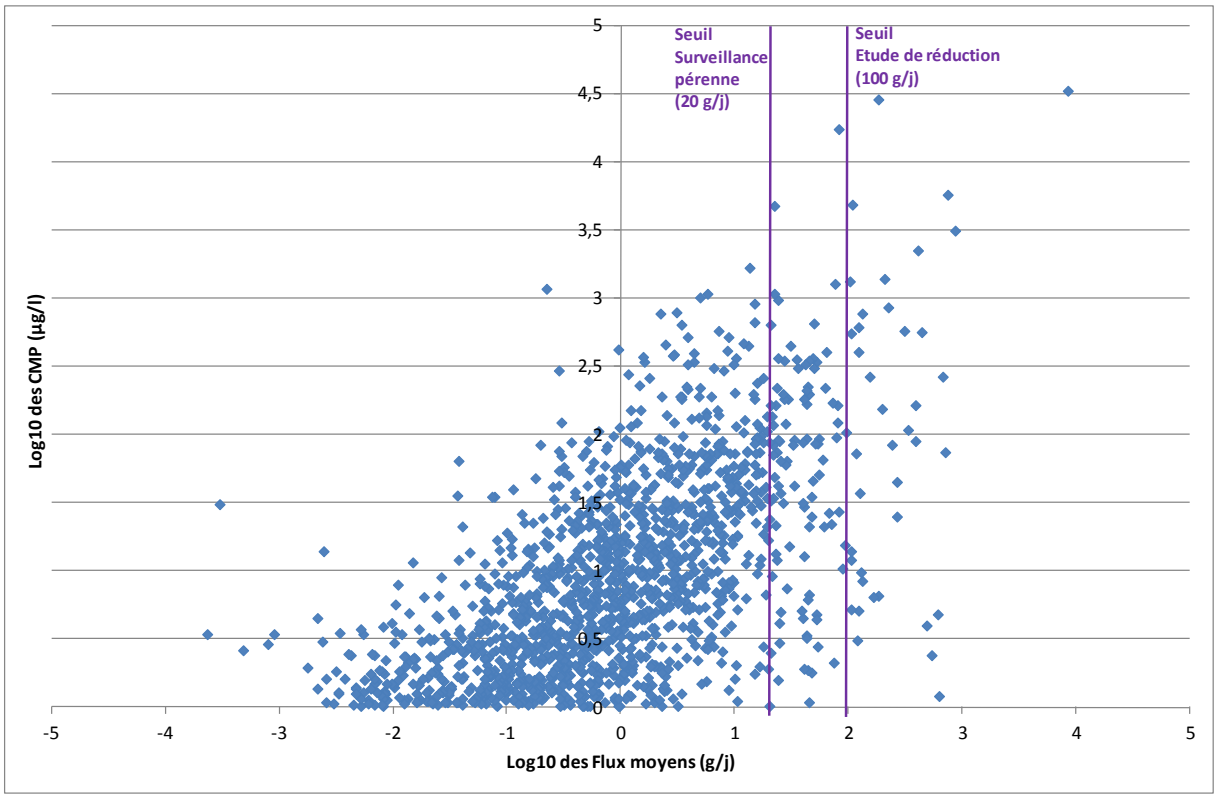


Figure 27: Chloroform emission levels at all release points (weighted average concentrations according to average flows)

The chemical sector appears to be the main contributor to chloroform flows (56% of total emitted flow). 3 other sectors, the agri-food industry (products of animal origin), the agri-food industry (products of plant origin) and surface treatment individually contribute to more than 10% of the total flow (11%, 10% and 9%, respectively).

Of the 3,069 sites that tested for chloroform, 131 sites exceeded the long-term monitoring threshold, 34 of which also exceeded the reduction study threshold. These 34 sites represent 73% of the total flow. The emission levels of these sites are between:

- Average flow: ≈ 100 g/d to 8,500 g/d

- WAC: ≈ 1 µg/l to 33,200 g/l

The main contributor in flow has a release of about 8.5 kg/d. The remaining 33 sites above the reduction study threshold have releases of between 100 and 1,100 g/d.

At the sites under reduction studies, about a quarter of the release points are at concentrations > 1 mg/l, with flow rates < 1000 m^3/d. On the other hand, about one-third of the release points have concentrations < 10 EQS with flow rates > 10,000 m^3/d.

The detailed study of site-by-site releases on sites subject to reduction studies highlights the fact that several chemical sites that appear to be the largest contributors to chloroform releases produce chloroform, or chlorine and derivatives, while some use chloroform.

Chloroform and trihalomethanes are formed by the action of chlorine on organic matter present mainly in surface waters. Some water treatments (purifying, cooling circuits, effluent treatment) or industrial disinfection with chlorine can therefore be the cause of chloroform formation.

INERIS' technical and economic data sheet indicates that industrial effluents can be treated by various processes that are effective in removing chloroform (in particular activated carbon filtration). Like many other HVOCs, chloroform can also be treated by stripping[100], especially if the goal is to recover it for recycling.

The BREF on the paper industry offers methods for reducing chloroform formation, including a chlorine-free bleaching method. The BREF on the textile industry indicates that the use of hydrogen peroxide in place of sodium hypochlorite prevents the formation of chloroform during bleaching. Finally, the BREF on cooling systems offers several alternatives to the use of chlorine or its derivatives. However, no BAT-AELs are set in these BREFs.

[100] This is an operation during which a gaseous solute is expelled from the water by the action of another gas called a gas scrubber. The gas scrubber causes a drop in partial pressure of the component to be removed in the gas phase, and thus causes its degassing.

Main industrial uses	- Chloroform is produced industrially. In France, chloroform production remained constant at 90,000 t/year and came from the Solvay Group factories in Tavaux and Arkema in Lavéra (INERIS technical economic data sheet, 2015). - Mainly used as synthesis intermediate in the chemical industry (more than 90% transformed into chlorodifluoromethane: this molecule used as a refrigerant (HCFC-22) is also used for the synthesis of fluoropolymers such as Teflon® (PTFE)). Thus, although HCFC-22 will be banned from use in 2020 to protect the stratospheric ozone layer, the demand for chloroform remains constant due to the increased demand for fluoropolymers. - It is also used as a solvent in the chemical industry, in the plastics industry and in the pharmaceutical industry for the extraction of essential oils and alkaloids, antibiotics, hormones, nicotine, quinine. - It is also used as a degreasing agent for surface treatment or in the metallurgy, textile or plastics sectors.
Other uses or sources of emissions	- Chloroform and trihalomethanes are formed by the action of chlorine on organic matter present mainly in surface waters. Some water treatments (purifying, cooling circuits, effluent treatment) or industrial disinfection with chlorine can therefore be the cause of chloroform formation. - It is widely established that chloroform sources are both anthropogenic and natural, with a strong contribution from natural sources to total flows in the environment.
Regulatory status	- Listed in REACH Annex XVII: prohibited use as a substance or in mixture containing more than 0.1% m/m intended for the public or widespread use such as surface cleaning. - There is an ongoing process at the European level that may lead to a restriction for intentional use.
Links / Resources	- INERIS technical and economic data sheet (2015)

3.3 BTEX

The BTEXs tested for in the framework of the RSDE2 action are benzene, toluene, ethylbenzene, xylenes (total o, m, p) and isopropylbenzene.

BTEXs are mono-aromatic compounds mainly derived from petroleum. They are used as synthesis intermediates in the manufacture of chemical and petrochemical products. They are very volatile compounds.

The BTEX family represents only 3% of the analyses. Overall, approximately 23% of the analyses resulted in a quantified result. Depending on the substances, between 10 and 30% of the sites quantified these substances in their releases at least 3 times.

There are 29 reduction studies regarding the BTEX family, and concern benzene, toluene and xylenes (total o, m, p).

The origins and uses identified for these substances are as follows:

- Benzene: recovered, mainly from refineries, from pyrolysis gasoline and reformed gasolines. Basic molecule of organic chemistry: used in the production of a very large number of chemicals. Additive for unleaded gasoline. Solvent in the perfume industry, in paints, cleaning products and printing.
- Toluene: used as a solvent and additive for different products (paints, inks, pharmaceuticals and cosmetics). Motor gasoline (5-7% toluene).
- Xylenes: solvent in paints, varnishes, glues, insecticides, dyestuffs. Also used in the rubber industry, pharmaceuticals and in histology laboratories

- Benzene:

Most of the benzene flows are discharged by the chemical sector (88% of the total flow, 6 sites under reduction studies) and the refineries sector (10% of the total flow, 4 sites under reduction studies). 2 sites in the steel industry are also under reduction studies.

- Toluene:

The majority of toluene flows are discharged by the chemical sector (94% of the total flow, 11 sites under reduction studies).

- Xylenes:

Most of the xylenes flows are discharged by the refineries sector (47% of the total flow, 2 sites under reduction studies) and the chemical sector (47% of the total flow, 4 sites under reduction studies).

Examples of reduction solutions at chemical sites have been drawn up:

- implementation of a toluene treatment system by stripping to cut down 99% of the toluene contained in its releases[101];
- reduction of toluene consumption by direct distillation;
- cessation of the use of orthoxylene, etc.

The BTEXs are a part of the framework of the Ministerial Order of 2 February 1998. Benzene, xylenes and ethylbenzene are included in Appendix Vb and toluene and isopropylbenzene in Appendix Vc1 of this Order[102].

[101] Source: Union des Industries Chimiques.

[102] Substances referred to in section 15 of paragraph 3 of Article 32 for which an emission limit value is set for the facility's release point, for the final release and in cumulated flows and concentrations (non-specific ELV for these substances); Appendix V b: Long-term toxic or harmful substances for the aquatic environment (ELV: 1.5 mg/L if the release exceeds 1 g/d); Appendix Vc1: Harmful substances for the aquatic environment (ELV: 4 mg/L if the release exceeds 10 g/d).

3.4 ALKYLPHENOLS

The alkylphenols tested for in the framework of the RSDE2 action are nonylphenols (priority hazardous substances), octylphenols (priority substances) and their ethoxylated derivatives[103].

Note that metrological difficulties for analysing alkylphenols or for entering data in the database could have been encountered during the action, which could possibly lead to the results being overestimated. These elements are detailed in section 3.3.2.2. As a consequence, emission levels and cases of long-term monitoring thresholds and/or reduction studies being exceeded may be overestimated[104]. However, the analysis results may also have been underestimated. These results are therefore presented here as an indication.

The family of alkylphenols represents 21% of the analyses (the second most tested for family). Overall, approximately 31% of the analyses resulted in a quantified result. Nonylphenols and octylphenols are overall frequently quantified (quantified at least 3 times by 81% and 68% of sites respectively), while their ethoxylated derivatives are less frequently quantified (between 15 and 20% of sites approximately).

90 reduction studies (about 15% of the reduction studies) focus on alkylphenols, which is the third most affected family of substances in reduction studies after metals and HVOCs. For long-term monitoring actions, it is the second most concerned family after metals (285 long-term monitoring actions, or about 17% of all long-term monitoring actions).

Nonylphenols and nonylphenol ethoxylates are the substances most affected by reduction studies (62 and 21 reduction studies, respectively). Nonylphenols are the subject of a detailed analysis below. 4 and 3 reduction studies concern octylphenols and their ethoxylates, respectively.

One of the means of action on nonylphenol emissions may be substitution. Substitution by ethoxylated alcohols or ethoxylated fatty alcohols seems possible for many applications: detergents, cleaning agents, water-dispersed paints and glues, textiles, etc.[105]. However, it appears to be less efficient, which often implies a larger dosage of the substitute product. For the formulation of phenol-formaldehyde resins, substitution by other substances does not seem possible.

Alkylphenols are not regulated in the Ministerial Order of 2 February 1998 and other sectoral ministerial orders regulating classified facilities.

A study entitled “Identification of Residual Sources of Alkylphenols” was conducted by INERIS[106].

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[103] Nonylphenol monoethoxylated (NP1EO), nonylphenol diethoxylated (NP2EO), octylphenol monoethoxylated (OP1EO) and octylphenol diethoxylated (OP2EO).

[104] For nonylphenols in particular, the results (SANDRE 6598) could be overestimated because results in the 1957 form could actually correspond to the 1958 form. In this case, code 6598 corresponds to 2 times the relevant form (1958) to be tested for, implying much higher concentration levels than reality since the 1957 form is *a priori* not present in the environment. In some cases, the results could have thus potentially been doubled. For example, for sites whose nonylphenol flow is between 10 and 20 g/d, if the flow has been doubled, these sites are in fact not subject to a reduction study (the threshold being 10 g/day). This is the case for a maximum of 29 sites (with an average flow of between 10 and 20 g/d) out of the 62 sites that are *a priori* subject to a reduction study.

[105] Background document on nonylphenol / nonylphenol ethoxylates – OSPAR Commission 2009.

[106] INERIS report “Identification of Residual Sources of Alkylphenols”, Lenoble C., Reference INERIS-DRC-15-144773-10461A, ONEMA - INERIS Convention, 2015.

3.4.1 NONYLPHENOLS

Status of the substance	Priority Hazardous Substance (WFD)
EQS	0.3 µg/l

Nonylphenols are frequently quantified overall (81% of the sites have quantified nonylphenols at least 3 times in their releases) and by all sectors (the 26 sectors out of 27 that have tested for it and have more than 10 sites, with quantification frequencies from 60% to 100% - 18 sectors between 80 and 95%).

The following graph shows the emission levels of all the points of release from which nonylphenols were tested for.

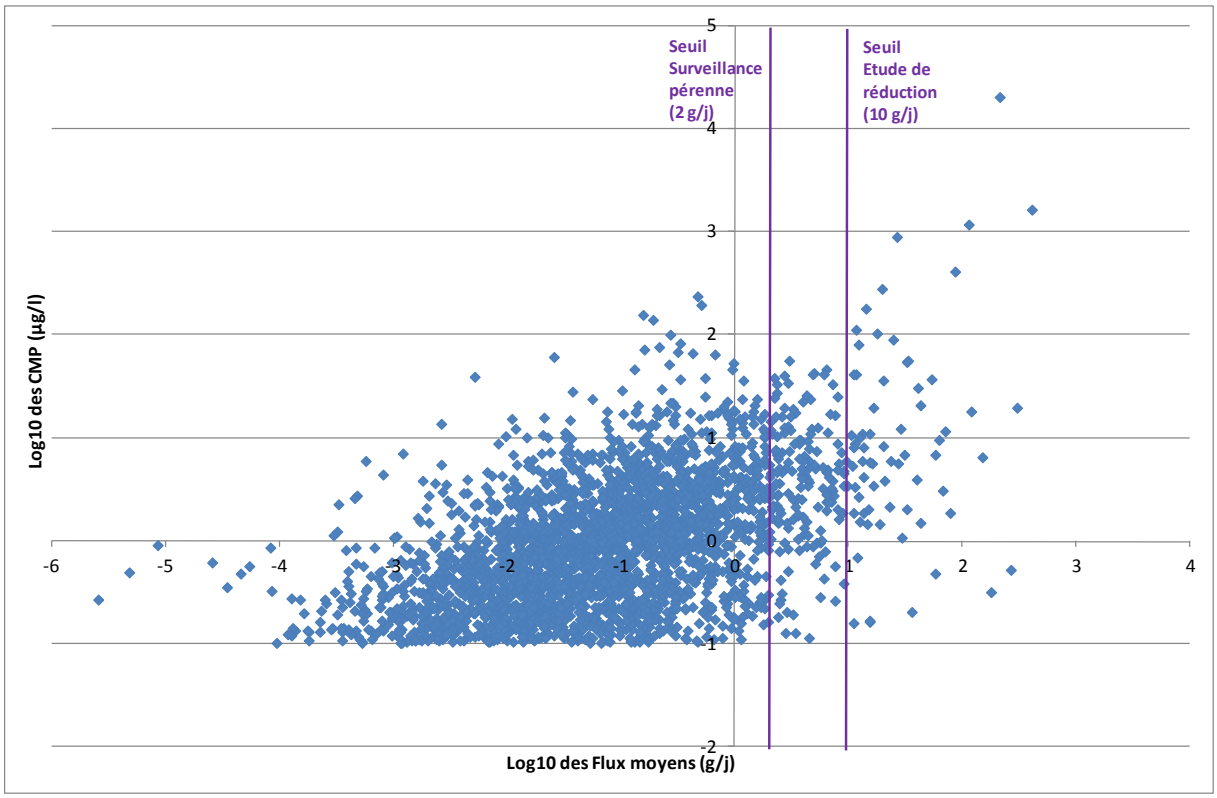

Figure 28: Nonylphenols emission levels at all release points (weighted average concentrations according to average flows)

Approximately 80% of the total flow is discharged by 6 sectors: chemicals (24%), the agri-food industry (products of plant origin) (20%), finishing (13%), paper/ cardboard manufacturing (13%), the agri-food industry (products of animal origin) (8%) and surface treatment (5%).

For the agri-food sector (products of plant origin), some of the flows come from water spread (return to the ground of the water used to wash vegetable raw materials).

Of the 3,104 sites that tested for nonylphenols, 216 sites exceeded the long-term monitoring threshold, 62 of which also exceeded the reduction study threshold. These 62 sites represent 75% of the total flow.

The emission levels of these sites are between:

- Average flow: ≈ 10 g/d to 500 g/d
- WAC: ≈ 5 µg/l to 20,100 µg/l

Some major contributors are the result of high flow rates associated with relatively low concentrations (especially in the chemical and paper/ cardboard manufacturing sectors).

Nonylphenols

Main industrial uses	- Majority use: Production of nonylphenol ethoxylates. Nonylphenols are the precursors in the manufacture of nonylphenol ethoxylates[107], which in turn degrade into nonylphenols in the environment. - Production of phenolic oximes. - Intermediates for the production of plastics: phenol-formaldehyde resins (monomer), trinonylphosphite, epoxy resins (catalyst), etc.
Other uses or sources of emissions	- Very strong decline in use, or even nil in the EU. - Presence in France most likely from imported items, especially textiles. - Possible presence in traces in some products. - Nonylphenols are found in both channelled and diffuse releases (industrial, urban, rain, etc.). A better assessment of diffuse sources of emissions would be needed.
Regulatory status	Nonylphenols and nonylphenol ethoxylates may not be placed on the market or used as substances or constituents of preparations in concentrations greater than or equal to 0.1% by mass for the following uses (Directive 2003/53/EC[108], repeated in Annex XVII of the REACH Regulation): - industrial and institutional cleaning (except when cleaning liquids are recycled or incinerated); - household cleaning products; - textile and leather treatment (unless certain treatments are put in place); - emulsifier in agricultural teat dip treatment products; - metal machining (except when cleaning liquids are recycled or incinerated); - paper and pulp manufacturing; - cosmetic and personal hygiene products (except spermicides); - co-formulants in pesticides and biocides (pesticides and biocides with a national authorisation granted before 17 July 2003 are exempted from this provision until their authorisation expires). Nonylphenol: Substance listed as a SVHC candidate in December 2012, because of its endocrine disrupting action for aquatic environments.
Links / Resources	- INERIS technical and economic data sheet (2012) - Annex XVII REACH, ECHA documents and website - Background document on nonylphenol/ nonylphenol ethoxylates – OSPAR Commission 2009. - Thesis “Source, transfer and fate of alkylphenols and bisphenol A in the upstream basin of the Seine”, Mathieu Cladière (2012)

As it is relevant to test for ethoxylates in parallel with nonylphenols (see section 2.3.2), a summary table is also presented on these substances.

[107] Nonylphenol monoethoxylate (NP1EO) and nonylphenol diethoxylate (NP2EO) were tested for as part of the RSDE2 action.

[108] Directive 2003/53/EC of the European Parliament and of the Council of 18 June 2003 amending for the twenty-sixth time Council Directive 76/769/EEC relating to restrictions on the marketing and use of certain hazardous substances and preparations (nonylphenol, nonylphenol ethoxylate and cement).

Nonylphenol ethoxylates

Main industrial uses	- Nonylphenol ethoxylates have surfactant properties that allow for the better dispersion of liquids and miscibility of certain substances such as oil and water. - The use of formulated products containing nonylphenol ethoxylates is likely in various industrial sectors such as metal smelting, mechanical working of metals, textiles, tanning, oil extraction and production, as well as in certain flocculants or even in paint. However, it is difficult to obtain information from potential users to the extent that the user is not aware of the presence of this substance in the products used.
Other uses or sources of emissions	- Nonylphenol ethoxylates are incorporated into concrete additive formulations (air entrainer, plasticiser, etc.) or emulsifier for bitumen. - Some cosmetic products such as shampoos may contain nonylphenol ethoxylates.
Regulatory status	- Nonylphenols and nonylphenol ethoxylates may not be placed on the market or used as substances or constituents of preparations in concentrations greater than or equal to 0.1% in mass for some uses - see the summary table on nonylphenols above (Directive 2003/53/EC[109], repeated in Annex XVII of the REACH Regulation). - Annex XVII of the REACH Regulation also states that nonylphenol ethoxylates may not be placed on the market after 3 February 2021 in textile items which can reasonably be expected to be washed with water during their normal life cycle, at concentrations greater than or equal to 0.01% by weight of the textile item or of each part of the textile item. This provision does not apply to the placing on the market of second-hand textile items or new textile items made exclusively from recycled textiles without the use of nonylphenol ethoxylates.
Links / Resources	INERIS technical and economic data sheet (2012)

[109] Directive 2003/53/EC of the European Parliament and of the Council of 18 June 2003 amending for the twenty-sixth time Council Directive 76/769/EEC relating to restrictions on the marketing and use of certain hazardous substances and preparations (nonylphenol, nonylphenol ethoxylate and cement).

3.5 BROMINATED DIPHENYL ETHERS (BDE)

7 congeners of the family of brominated diphenyl ethers (BDE) were tested for in the framework of the RSDE2 action: Tetrabromodiphenyl ether (BDE-47), Pentabromodiphenyl ether (BDE-99), Pentabromodiphenyl ether (BDE-100), Hexabromodiphenyl ether (BDE-153), Hexabromodiphenyl ether (BDE-154), Heptabromodiphenyl ether (BDE-183) and Decabromodiphenyl ether (BDE-209)[110].

The BDE family represents 8% of the analyses.

Decabromodiphenyl ether (BDE-209) was quantified at least 3 times by 45% of the sites that tested for it. For other BDEs, this quantification frequency is about 20%.

Relatively few cases of reduction study thresholds being exceeded concern BDEs (8 cases). The action thresholds (monitoring and reduction) concern the total of the flows of all the BDEs. However, it can be seen that almost all the flows measured concern decabromodiphenyl ether (BDE-209). It is the subject of a detailed analysis below. The other measured flows are all less than 0.4 g/d for BDE-99 and less than 0.2 g/d for all other BDEs.

One of the means of action on brominated diphenyl ether emissions may be substitution with other non-brominated flame retardants. Brominated diphenyl ethers are not regulated in the Ministerial Order of 2 February 1998 and other sectoral ministerial orders regulating classified facilities.

Brominated diphenyl ethers

Main industrial uses	- No use at present. Not produced in Europe. - They were used as a flame retardant.
Other uses or sources of emissions	- Potentially present in recycled plastics and end-of-life products: waste from electrical and electronic equipment (WEEE), furniture waste, end-of-life vehicles (ELV).
Regulatory status	- Several substances in the family of brominated diphenyl ethers, which are precursors that can degrade into pentabromodiphenyl ether in the environment, are prohibited at European level (octabromodiphenyl ether) or are in the process of being prohibited (decabromodiphenyl ether). The ban on decabromodiphenyl ether, which is still used in the production of plastics and textiles (and present in imported articles) at around 4 000 t/year in the EU, is expected to be ratified in 2016 as part of the REACH regulation. One of the main sources of pentabromodiphenyl ether (other than the considerable stocks existing in products or the environment) will therefore be eliminated. - Annex A of the Stockholm Convention on Persistent Organic Pollutants (POP).
Links / Resources	- INERIS technical and economic data sheets on pentabromodiphenyl ethers (2013) and on octabromodiphenyl ethers (2006). - Annex XVII REACH, ECHA website and documents - Study on waste related issues of newly listed POPs and candidate POPs – ESWI 2010. - Report of the Persistent Organic Pollutants Review Committee on the work of the second meeting - risk profile for pentabromodiphenyl ether (commercial mixture, c-pentabromodiphenyl ether) - UNEP, Geneva 2006. - Report of the Persistent Organic Pollutants Review Committee on the work of the third meeting - risk profile for octabromodiphenyl ether (commercial mixture, c-octabromodiphenyl ether) - UNEP, Geneva 2007.

[110] The classification used in this report (BDE-99 and 100 as priority hazardous substances and BDE-47, 153, 154, 183 and 209 as priority substances) is the one that was used in the circular of 5 January 2009. However, brominated diphenyl ethers are currently classified as priority hazardous substances (in Directive 2013/39/EU, amending the Water Framework Directive 2000/60/EC). Furthermore, decabromodiphenyl ether (BDE-209) is not covered by this directive, whereas BDE-28 is.

3.5.1 DECABROMODIPHENYL ETHER (BDE-209)

80% of the total flow is discharged by 2 sectors: chemicals (60%, 5 sites under reduction studies) and the plastic industry (30%, 3 sites under reduction studies).

1,025 sites tested for decabromodiphenyl ether (BDE-209). Due to the flows of BDE-209, 10 sites exceeded the long-term monitoring threshold, 8 of which also exceeded the reduction study threshold. These 8 sites represent 87% of the total flow.

The emission levels of these sites for BDE-209 are between 10 and 60 g/d in average flow, with concentrations of 43 to 210 µg/l.

Decabromodiphenyl ether (BDE-209)

Main industrial uses	- Universal flame retardant (polymer, textiles, composite materials, adhesive, glue, coatings, etc.). - Not produced in Europe.
Other uses or sources of emissions	- Emissions from preparation, formulation, batching, molding, injection or finishing sites. - Due to the presence of decabromodiphenyl ether in end-of-life products, the possibility of emissions from waste management sites (waste from electrical and electronic equipment, fabric treatment, recycled plastics, etc.).
Regulatory status	- Included on the list of substances of very high concern candidates for authorisation under the REACH Regulation for its very persistent and very bioaccumulative (vPvB) status since 2012. - Inclusion of decabromodiphenyl ether in Annex A of the Stockholm Convention on Persistent Organic Pollutants (POPs) is under consideration.
Links / Resources	- INERIS technical and economic data sheet on decabromodiphenyl ethers (2006). - Report of the Persistent Organic Pollutants Review Committee on the work of the second meeting - risk profile for decabromodiphenyl ether (commercial mixture, c-decabromodiphenyl ether) - UNEP, Geneva 2014.

3.6 POLYCYCLIC AROMATIC HYDROCARBONS (PAH)

9 PAHs were tested for in the framework of the RSDE2 action: benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene), anthracene, fluoranthene, naphthalene and acenaphthene.

Of these 9 PAHs, acenaphtene was only tested for in the chemical sector (not included in the sector-specific lists of other sectors) and 5 PAHs were only tested for in 8 sectors[111]. The 3 PAHs most often tested for are fluoranthene and naphthalene (34 sectors) and anthracene (24 sectors).

Naturally present in fossil fuels, they are also generated by their incomplete combustion (coal, fuel oil, tar, asphalt, diesel), or the incomplete combustion of organic matters. 4 of these PAHs are of petroleum origin (so-called “petrogenic”), found in non-negligible concentrations in groundwater and seafood (acenaphthene, anthracene, fluoranthene, naphthalene). The 5 other so-called “pyrolytic” PAHs, that is to say those resulting mainly from the incomplete combustion of organic matter and in particular petroleum products (such benzopyrene), are among the most toxic, but they are not very soluble and are found less often in the water compartment of the aquatic environment[112]. They are not produced voluntarily by humans, except in very small quantities for research purposes.

Only the 4 PAHs of petroleum origin are or have been the subject of intentional production and use (particularly naphthalene), so how they are used may lead to dispersive uses.

- Naphthalene: around 100,000 tonnes produced per year in the European Union[113]. Mainly intermediate synthesis. Used for the synthesis of dyes, phthalic anhydride (which is an intermediate for the production of plastics, dyes or pigments) and naphthalene sulfonate salts (which are used as surfactants mainly in paper sectors, for the manufacture of concrete or plaster (superplasticizer) but also for the formulation of pesticides or the treatment of leather).
- Anthracene: produced in the European Union at a rate of 550 tonnes per year. Chemical intermediate, biocide, electrophotography.
- Fluoranthene: no longer seems to be produced industrially, either in France and or worldwide. Past uses: intermediate in the manufacture of dyes, including fluorescent dyes and in the manufacture of dielectric oils; stabiliser for epoxy glues. Protective coating for the interior of steel tanks and pipes used for the storage and distribution of drinking water. INERIS’ technical and economic data sheet (2006) specifies that no information indicating that these uses still exist is available.

Fluoranthene and naphthalene are present in creosote[114] used for treating wood, whose uses are constantly decreasing (due to strong limitations).

- Acenaphthene: intermediate in the manufacture of dyes, plastics and pesticides.

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[111] Benzo(a)pyrene, benzo(b)fluoranthene, benzo(g, h, i)perylene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene.

[112] Seine-Normandy Water Agency Guide, “A Practical Guide to Toxic Substances in the Freshwater and Coastal Watersheds of the Seine-Normandy Basin”, ISBN 978-2-9523536-2-5, May 2008.

[113] INERIS Report, “Classification of Substances and Measurement Programs (PDM), Decision Support Elements”, Gouzy A., Denize C., Jéhanne M., Reference INERIS-DRC- 14-136882-01394A, ONEMA - INERIS Convention, 2014.

[114] Regulatory framework for the use of creosote: will be prohibited unless operators apply for a derogation. The railway sleepers' case is currently being examined at European level. To date, substitution treatments exist for the treatment of wood (copper salts, chemical agent, oleothermy, etc.) nevertheless without providing a level of protection equivalent to the use of creosote.

Fluoranthene and naphthalene were quantified at least 3 times by 40% and 32% of the sites that tested for them, respectively. For other PAHs, this quantification frequency is between 10 and 20% approximately.

Relatively few cases of reduction study thresholds being exceeded concern PAHs (15 cases in total, including 9 on naphthalene and anthracene).

- Naphthalene:

The majority of the total flow is discharged by 2 sectors: chemicals (65%, 4 sites under reduction studies) and refineries (18%, 1 site under a reduction study). 1 site of the non-ferrous metal production/ processing sector is also under a reduction study.

- Anthracene:

Approximately 80% of the total flow is discharged by 2 sectors: refineries (40%, 1 site under a reduction study) and chemicals (38%, 1 site under a reduction study). 1 site of the steel sector is also under reduction study.

- Fluoranthene:

Approximately 80% of the total flow is discharged by 5 sectors: the agri-food industry (products of plant origin), refineries, chemicals, the steel industry and production/ transformation of non-ferrous metals.

2 sites exceed the thresholds for reduction studies, including a site in the agri-food sector (products of plant origin) (for which the flows concerned come from water spread: return to the ground of the water used to wash vegetable raw materials full of soil) and 1 site in the refineries sector.

- Other PAHs:

For the other 5 other priority hazardous PAHs (benzo(a)pyrene, benzo(k)fluoranthene, benzo(b)fluoranthene, benzo(g, h, i)perylene and indeno(1,2,3-cd)pyrene), only one site in the chemicals sector exceeded the reduction study thresholds[115] (this is the site with the highest measured concentrations for these substances in the framework of the RSDE2 action, between 80 and 200 µg/l depending on the substance).

Acenaphthene was only tested for in the chemicals sector and no cases of it exceeding the reduction study thresholds are observed.

PAHs are a part of the framework of the Ministerial Order of 2 February 1998. In particular, “PAHs (especially 3,4-benzopyrene and 3,4-benzofluoranthene)” are included in Appendix Va and naphthalene and anthracene in Appendix Vb of the Ministerial Order of 2 February 1998[116].

[115] For benzo(a)pyrene, benzo(b)fluoranthene, benzo(g, h, i)perylene and indeno(1,2,3-cd)pyrene. However, the benzo(k)fluoranthene flow is just below the reduction study threshold (9.9 g/d for a threshold of 10 g/d).

[116] Substances referred to in section 15 of paragraph 3 of Article 32 for which an emission limit value is set for the facility’s release point, for the final release and in cumulated flows and concentrations (non-specific ELV for these substances); Appendix V a: Very toxic substances for the aquatic environment (ELV: 0.05 mg/L if the release exceeds 0.5 g/d); Appendix Vb: Long-term toxic or harmful substances for the aquatic environment (ELV: 1.5 mg/L if the release exceeds 1 g/d).

It is the anthropogenic[117] pyrolytic origin that is considered to be the major source of PAHs in the environment, particularly because of domestic and industrial emissions[118]. An analysis of the opportunities for action was conducted by INERIS in 2010[119]. This report shows that some actions are still possible despite the fact that most sources of emissions are atmospheric or out of the scope of the specific reduction measures that may be put in place within the framework of a programme of measures (such as in urban planning and road development for rainwater management, improving oil collection or other waste that may contain PAHs, or improving sediment treatment or river navigation).

[117] As opposed to diagenetic and petrogenetic sources.

[118] INERIS Report, “Classification of Substances and Measurement Programs (PDM), Decision Support Elements”, Gouzy A., Denize C., Jéhanne M., Reference DRC- 14-136882-01394A, ONEMA - INERIS Convention, 2014.

[119] INERIS report, “Investigation of the achievement of the good chemical status of water: Strategies for DEHP and PAHs”, Reference DRC-10-112065-14265A, Ducos G., ONEMA - INERIS Convention, 2010.

CONCLUSION

The second phase of the National Action for Research on and the Reduction of Releases of Hazardous Substances into Water Bodies (RSDE2) has improved the knowledge of releases of hazardous substances from a large number of ICPEs subject to authorisation or registration.

This report summarises the results of the initial monitoring conducted within this framework, on 3,722 sites selected after the data was validated, distributed over 41 industrial sub-sectors, at the national level. Overall, 112 substances were tested for in the releases, including substances targeted at the European level by the Water Framework Directive (WFD)[120] and substances deemed relevant to be monitored at the national level.

Notwithstanding the limitations as regards the data set used as discussed in section 3, the results of this study shed light on:

- the presence of substances in releases at quantifiable concentrations (given the current state of available techniques);
- the release levels (in concentrations and flows) of these substances;
- the proportion of sites whose releases exceed the thresholds for long-term monitoring actions and reduction studies, on the basis of national criteria, by substance and industrial sector;
- substances of global interest versus those subject to targeted actions and the potential reductions in releases of these substances.

These results have been analysed globally and on a sectoral-basis, and detailed analyses for some substances are presented in this report. The overall results for each specific substance and industrial sector are also provided in two documents attached to this report (Reports INERIS-DRC-16-149870-01979B and INERIS-DRC-16-149870-01981B).

55 substances were quantified at least three times by more than 10% of the sites. The most frequently measured substances are zinc, copper and nonylphenols, as well as octylphenols, 3 other metals (chromium, nickel and lead), decabromodiphenyl ether (BDE-209), chloroform, 2 PAHs (fluoranthene and naphthalene), 2 chlorophenols (2,4,6-trichlorophenol and 2-chlorophenol), monobutyltin cation, tributylphosphate and biphenyl.

Substances with the highest emission levels, in the 90th percentile (i.e. the value above which the highest 10% of releases are found), in both average concentrations and flows, are 6 of the 8 metals (zinc, copper, nickel, chromium, lead, arsenic), HVOCs (chloroform and methylene chloride), BTEXs (xylenes and toluene) and nonylphenols.

For most substances, the total quantities released are mainly the result of the largest contributors (above the 90th percentile).

As regards priority hazardous substances, which are ultimately targeted by the emission phasing-out objective of the Water Framework Directive, these substances are found in quantifiable concentrations by a minority of sites, with the notable exception of nonylphenols.

A comparison of the concentration levels with the reference values to assess the status of water bodies (environmental quality standards, EQS)[121] was performed to evaluate the potential local impact of releases on the receiving environments. This analysis shows that zinc

[120] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for a Community action in the field of water policy.

[121] Some substances do not have an EQS or these are for the biota and not for the water compartment. The comparison of the release levels with the EQS is therefore not carried out for these substances.

and copper, which are the two most found substances in the releases, are released with weighted average concentrations higher than 10 EQS, for more than 75% and 50% of the releases, respectively. Conversely, for other substances, less than 10% of releases have weighted average concentrations above 10 EQS.

55 substances or groups of substances are released (by at least one site) at flow levels that exceed the long-term monitoring action. Of these, 44 also exceed the reduction study thresholds.

The families of substances most affected by the long-term monitoring and reduction study actions are mainly metals, as well as HVOCs and alkylphenols. The most affected substances in these families are zinc, nickel, nonylphenols and chloroform.

In contrast, some substances are infrequently quantified and overall released in small quantities by all sites (such as pesticides, tributyltin cation, etc.).

The results show that releases from sites exceeding the reduction study thresholds represent more than 60% of the total flows emitted by all the studied sites for the majority of substances, and even more than 80% of the total flows for 28 substances. Significant reductions in emissions of these substances can therefore be expected by acting on the major contributors via the reduction studies.

The only initial monitoring results available in the database do not allow a precise assessment of the reduction that can actually be achieved on a case-by-case basis by these reduction studies. In addition, some of these studies will be imposed locally based on criteria related to the receiving water bodies.

On the other hand, overall, the only improvement in knowledge of emissions has encouraged actions to reduce releases.

As regards the 3,722 sites selected for this study (in August 2014, after data validation) out of 4,821 sites for which the initial monitoring was recommended (as of October 2015):

- 897 sites (about 24%) have releases that exceed the long-term monitoring thresholds for one or more substances;
- 358 sites (about 10%) have releases that exceed the reduction study thresholds for one or more substances[122].

In addition, for each substance, comparing the flow levels with the flow threshold values that trigger the implementation of long-term monitoring actions and reduction studies shows that less than 10% of the release points are affected by long-term monitoring, and a fortiori reduction studies.

On the basis of the indicators reported by the inspection of the classified facilities, the report submitted by the DGPR in October 2015[123] is as follows:

[122] Note that these involve estimates of the number of the monitoring and reduction study actions (based on the results available in the database), obtained by comparison with the daily flow threshold criteria that trigger these actions only. Moreover, although they could not be studied in this report, other criteria relating to the impact of releases on the receiving environment are in particular applied locally and result in the recommendation of additional actions on the ground, which explains, in particular, the discrepancy noted with the data reported by the inspection of the classified facilities.

[123] Source: Ministry of the Environment, Energy and the Sea, on the basis of the indicators reported by the inspection of the classified facilities in the management software of the S3IC classified facilities in October 2015.

- 1,730 sites (about 36%) are involved in at least one long-term monitoring action for one or more substances;
- 640 sites (about 13%) are involved in at least one reduction study for one or more substances.

The differences between the figures presented in this study and those reported by the inspection of the classified facilities, in terms of the proportion of sites affected by long-term monitoring actions and/or reduction studies, can be explained in particular by taking into account the local impact criteria of the releases on the receiving environment, which justifies the recommendation of these actions[124]. These criteria were devised at the national level and applied on the ground at the local level but cannot be taken into account in this study because they are not included in the database that was used.

These analyses of the results confirm the interest of the approach chosen in the framework of the RSDE action, whose objective is to quantify emissions from all the sites, then target reduction efforts on the main national industrial contributors (contribution to the national reduction objectives resulting from the implementation of the Water Framework Directive) and towards the environments most directly affected by the ICPEs' releases (contribution to the WFD's objectives of good status of water bodies).

The overall results make it possible to clarify, according to the substances, to what extent releases of these substances are an industrial problem, and if they concern one or more industrial sectors, making it possible to target the most relevant actions at a national level (collective actions, or targeted actions at a few sites that mainly contribute to emissions).

It should also be noted that ICPEs are not the only contributors to emissions of hazardous substances into aquatic environments. In the strategies for reducing emissions of hazardous substances into water developed at the national level, actions also concern other families of contributors to releases (such as handicrafts, runoff, agriculture, etc.).

[124] For example, the note of 27 April 2011 provides for the possibility of subtracting the "imported" flow of the water taken from the environment from the daily flow emitted by a site.

More broadly, the implementation of the national RSDE action also:

- led to improved practices for the collection and analysis of hazardous substances, and hence the quality of data;
- helped to define emission management measures at the local level (at river basins[125], site by site, etc.);
- helped to supply the RSDE studies carried out by several industrial branches on their industrial sectors on the basis of results;
- provided a significant and quality contribution to the inventory approach (and related reporting) of the emissions, releases and losses of priority substances to surface water required by the WFD in Article 5, on point releases from classified facilities on the one hand, and urban water treatment plants[126] on the other;
- contributed, within the scope of the ICPEs, to the national policy for combating the emissions of hazardous substances into water bodies implemented to meet the objectives of the WFD.

These results and the lessons learned over time as a result of the reduction studies are currently being exploited:

- on the one hand, in the context of preparing reference documents on the best available techniques (BREF) in order to take advantage of the knowledge acquired at the European level,
- on the other hand, in the context of the discussions initiated by the Ministry of the Environment concerning the possible revision of the opposable emission limit values[127] for classified facilities in light of these results.

[125] This report is a summary of results at the national level. The results at each basin may be more specific.

[126] The results of the RSDE action carried out by the urban water treatment plants are available in the INERIS report entitled “Hazardous Substances for the Aquatic Environment in Releases from Urban Waste Water Treatment Plants - Review of the National Action for Research on and the Reduction of Releases of Hazardous Substances in Water Bodies by Urban Waste Water Treatment Plants (RSDE) - Summary of Initial Monitoring Results”, Partaix H., INERIS Reference-DRC-15-136871-11867E, Convention ONEMA - INERIS, 2016.

[127] Defined by ministerial orders.

LIST OF APPENDICES

Point of Reference	Designation	Number of pages / Format
Appendix 1	Substances tested for (in alphabetical order)	5 A4
Appendix 2	Percentage of sites that have quantified the substance at least 3 times, for each substance (in descending order of percentage)	4 A4
Appendix 3	Distribution of the weighted average concentrations by flow rates (in µg/l), for each substance (in descending order on the 90th percentile value)	3 A4
Appendix 4	Distribution of average flows (in m^3/d) measured over all the points of release, for each industrial sector (in descending order on the 90th percentile value)	2 A4
Appendix 5	Distribution of average daily flows (in g/d), for each substance (in descending order on the 90th percentile value)	4 A4
Appendix 6	Number of sites under long-term monitoring and reduction studies, for each substance (in descending order of the number of sites under a reduction study)	2 A4
Appendix 7	Total number of long-term monitoring actions and reduction studies, and number of sites involved, by industrial sector (in descending order of the number of sites by industrial sector)	1 A4
Appendix 8	Number of sites affected by at least one long-term monitoring action and a reduction study, and percentage compared to the total number of sites, by industrial sector (in descending order of the number of sites affected by at least one reduction study)	1 A4
Appendix 9	Emission limit values (ELVs) of the Ministerial Order of 2 February 1998 regulating the classified facilities subject to authorisation and emission levels associated with the best available techniques (BAT-AELs) of the most recent BREFs	1 A4

Appendix 1:
Substances tested for
(in alphabetical order)

SANDRE Code	Substance	"Circular" QL (µg/l)	Long-term monitoring threshold (g/d)	Reduction study threshold (g/d)	Chemical family	Category
1160	1,1-Dichloroethane	5	300	2000	HVOC	Other relevant substances
1162	1,1-Dichloroethylene	2.5	300	2000	HVOC	Other relevant substances
1284	1, 1, 1-Trichloroethane	0.5	300	1000	HVOC	Other relevant substances
1285	1, 1, 2-Trichloroethane	1	300	2000	HVOC	Other relevant substances
1271	1,1,2,2-Tetrachloroethane	1	300	2000	HVOC	Other relevant substances
1165	1,2-Dichlorobenzene	1	300	500	Chlorobenzenes	Other relevant substances
1161	1,2-Dichloroethane	2	20	100	HVOC	Priority substances
1163	1,2-Dichloroethylene	5	300	2000	HVOC	Other relevant substances
1630	1,2,3-Trichlorobenzene	1	4	30	Chlorobenzenes	Priority substances
1283	1,2,4-Trichlorobenzene	1	4	30	Chlorobenzenes	Priority substances
1631	1,2,4,5-Tetrachlorobenzene	0.05	300	500	Chlorobenzenes	Other relevant substances
1164	1,3-Dichlorobenzene	1	300	500	Chlorobenzenes	Other relevant substances
1629	1,3,5-Trichlorobenzene	1	4	30	Chlorobenzenes	Priority substances
1166	1,4-Dichlorobenzene	1	300	500	Chlorobenzenes	Other relevant substances
1469	1-Chloro-2-nitrobenzene	0.1	300	500	Chlorobenzenes	Other relevant substances
1468	1-Chloro-3-nitrobenzene	0.1	300	500	Chlorobenzenes	Other relevant substances
1470	1-Chloro-4-nitrobenzene	0.1	300	500	Chlorobenzenes	Other relevant substances
1593	2-Chloroaniline	0.1	300	500	Anilines	Other relevant substances
1471	2-Chlorophenol	0.1	300	500	Chlorophenols	Other relevant substances
1486	2,4-Dichlorophenol	0.1	300	500	Chlorophenols	Other relevant substances
1548	2,4,5-Trichlorophenol	0.1	300	500	Chlorophenols	Other relevant substances
1549	2,4,6-Trichlorophenol	0.1	300	500	Chlorophenols	Other relevant substances
1602	2-Chlorotoluene	1	300	500	Chlorotoluenes	Other relevant substances
2613	2-Nitrotoluene	0.2	300	1000	Aromatic nitro compounds	Other relevant substances
1592	3-Chloroaniline	0.1	300	500	Anilines	Other relevant substances
1651	3-Chlorophenol	0.1	300	500	Chlorophenols	Other relevant substances
1586	3,4-Dichloroaniline	0.1	300	500	Anilines	Other relevant substances
2065	3-Chloroprene (Allyl chloride)	1	300	1000	HVOC	Other relevant substances
1601	3-Chlorotoluene	1	300	500	Chlorotoluenes	Other relevant substances
1591	4-Chloroaniline	0.1	300	500	Anilines	Other relevant substances
1650	4-Chlorophenol	0.1	300	500	Chlorophenols	Other relevant substances
1594	4-Chloro-2-nitroaniline	0.1	300	500	Anilines	Other relevant substances
1636	4-Chloro-3-methylphenol	0.1	300	500	Chlorophenols	Other relevant substances
1600	4-Chlorotoluene	1	300	500	Chlorotoluenes	Other relevant substances
1453	Acenaphthene	0.01	300	500	PAH	Other relevant substances
1465	Chloroacetic acid	25	300	500	Others	Other relevant substances
1101	Alachlor	0.02	4	100	Pesticides	Priority substances
1200	alpha-Hexachlorocyclohexane	0.02	-	-	Pesticides	Priority hazardous substances
1458	Anthracene	0.01	2	10	PAH	Priority hazardous substances
1178	alpha-Endosulfan	0.02	2	5	Pesticides	Priority hazardous substances
1369	Arsenic and its compounds	5	10	100	Metals	Substances with environmental status
1107	Atrazine	0.03	4	30	Pesticides	Priority substances
1114	Benzene	1	20	100	BTEX	Priority substances

SANDRE Code	Substance	"Circular" QL (µg/l)	Long-term monitoring threshold (g/d)	Reduction study threshold (g/d)	Chemical family	Category
1115	Benzo(a)pyrene	0.01	2	10	PAH	Priority hazardous substances
1116	Benzo(b)fluoranthene	0.01	2	10	PAH	Priority hazardous substances
1118	Benzo(ghi)perylene	0.01	2	10	PAH	Priority hazardous substances
1117	Benzo(k)fluoranthene	0.01	2	10	PAH	Priority hazardous substances
1179	beta-Endosulfan	0.02	2	5	Pesticides	Priority hazardous substances
1584	Biphenyl	0.05	300	2000	Others	Other relevant substances
1388	Cadmium and its compounds	2	2	10	Metals	Priority hazardous substances
1841	Total Organic Carbon	0,3	-	-	Monitoring parameters	Not defined
1464	Chlorfenvinphos	0.05	4	100	Pesticides	Priority substances
1955	Chloroalcanes C10-C13	10	2	10	Others	Priority hazardous substances
1467	Chlorobenzene	1	300	1000	Chlorobenzenes	Other relevant substances
1135	Chloroform	1	20	100	HVOC	Priority substances
2611	Chloroprene	1	300	1000	HVOC	Other relevant substances
1083	Chlorpyrifos	0.05	4	100	Pesticides	Priority substances
1168	Methylene chloride	5	20	100	HVOC	Priority substances
1753	Vinyl chloride	5	300	500	HVOC	Other relevant substances
1389	Chromium and its compounds	5	200	500	Metals	Substances with environmental status
1392	Copper and its compounds	5	200	500	Metals	Substances with environmental status
1815	Decabromodiphenyl ether (BDE-209)	0.05	-	-	BDE	Priority substances
1314	Chemical Oxygen Demand	30			Monitoring parameters	Not defined
7074	Dibutyltin cation	0.02	300	500	Organotins	Other relevant substances
1177	Diuron	0.05	4	30	Pesticides	Priority substances
1494	Epichlorohydrin	0.5	300	500	Others	Other relevant substances
1497	Ethylbenzene	1	300	1000	BTEX	Other relevant substances
1191	Fluoranthene	0.01	4	30	PAH	Priority substances
1203	gamma isomer Lindane	0.02	2	5	Pesticides	Priority hazardous substances
2910	Heptabromodiphenyl ether BDE-183	0.05	-	-	BDE	Priority substances
2912	Heptabromodiphenyl ether BDE-153	0.05	-	-	BDE	Priority substances
2911	Heptabromodiphenyl ether BDE-154	0.05	-	-	BDE	Priority substances
1199	Hexachlorobenzene	0.01	2	5	Chlorobenzenes	Priority hazardous substances
1652	Hexachlorobutadiene	0.5	2	10	HVOC	Priority hazardous substances
1656	Hexachloroethane	1	300	1000	HVOC	Other relevant substances
2612	Hexachloropentadiene	0.1	300	1000	HVOC	Other relevant substances

SANDRE Code	Substance	"Circular" QL (µg/l)	Long-term monitoring threshold (g/d)	Reduction study threshold (g/d)	Chemical family	Category
1204	Indeno(1,2,3-cd)pyrene	0.01	2	10	PAH	Priority hazardous substances
1633	Isopropylbenzene	1	300	1000	BTEX	Other relevant substances
1208	Isoproturon	0.05	4	30	Pesticides	Priority substances
1305	Suspended matter	2	-	-	Monitoring parameters	Not defined
1387	Mercury and its compounds	0.5	2	5	Metals	Priority hazardous substances
2542	Monobutyltin cation	0.02	300	500	Organotins	Other relevant substances
1517	Naphthalene	0.05	20	100	PAH	Priority substances
1386	Nickel and its compounds	10	20	100	Metals	Priority substances
2614	Nitrobenzene	0.2	300	1000	Aromatic nitro compounds	Other relevant substances
6598	Nonylphenols	0.1	2	10	Alkylphenols	Priority hazardous substances
6366	NP1OE	0.1	-	-	Alkylphenols	Other RSDE substances
6369	NP2OE	0.1	-	-	Alkylphenols	Other RSDE substances
6370	OP1OE	0.1	-	-	Alkylphenols	Other RSDE substances
6371	OP2OE	0.1	-	-	Alkylphenols	Other RSDE substances
1242	PCB 101	0.01	-	-	PCB	Other relevant substances
1243	PCB 118	0.01	-	-	PCB	Other relevant substances
1244	PCB 138	0.01	-	-	PCB	Other relevant substances
1245	PCB 153	0.01	-	-	PCB	Other relevant substances
1246	PCB 180	0.01	-	-	PCB	Other relevant substances
1239	PCB 28	0.01	-	-	PCB	Other relevant substances
1241	PCB 52	0.01	-	-	PCB	Other relevant substances
2915	Pentabromodiphenyl ether (BDE-100)	0.05	2	5	BDE	Priority hazardous substances
2916	Pentabromodiphenyl ether (BDE-99)	0.05	2	5	BDE	Priority hazardous substances
1888	Pentachlorobenzene	0.02	2	5	Chlorobenzenes	Priority hazardous substances
1235	Pentachlorophenol	0.1	4	30	Chlorophenols	Priority substances
1382	Lead and its compounds	5	20	100	Metals	Priority substances
6600	p-octylphenols (mixture)	0.1	10	30	Alkylphenols	Priority substances
1263	Simazine	0.03	4	30	Pesticides	Priority substances
2919	Tetrabromodiphenyl ether BDE-47	0.05	-	-	BDE	Priority substances
1272	Tetrachlorethylene	0.5	2	5	HVOC	Other priority hazardous substances
1276	Carbon tetrachloride	0.5	2	5	HVOC	Other priority hazardous substances
1278	Toluene	1	300	1000	BTEX	Other relevant substances
2879	Tributyltin cation	0.02	2	5	Organotins	Priority hazardous substances
1847	Tributyl phosphate	0.1	300	2000	Others	Other relevant substances
1286	Trichlorethylene	0.5	2	5	HVOC	Other priority hazardous substances
1289	Trifluralin	0.05	4	100	Pesticides	Priority substances
6372	Triphenyltin cation	0.02	300	500	Organotins	Other relevant substances
1780	Xylenes (total o, m, p)	2	300	500	BTEX	Other relevant substances

SANDRE Code	Substance	"Circular" QL (µg/l)	Long-term monitoring threshold (g/d)	Reduction study threshold (g/d)	Chemical family	Category
1383	Zinc and its compounds	10	200	500	Metals	Substances with environmental status

Groups of substances

6366, 6369	*Nonylphenol ethoxylates*	*-*	*2*	*10*	*Alkylphenols*	*Other RSDE substances*
1815, 2910, 2912, 2919, 2911, 2916, 2915	*Brominated diphenyl ethers*	*-*	*2*	*5*	*BDE*	*Priority substances*
6370, 6371	*Octylphenol ethoxylates*	*-*	*10*	*30*	*Alkylphenols*	*Other RSDE substances*
1200 ,1203	*Hexachlorocyclohexane*	*-*	*2*	*5*	*Pesticides*	*Priority hazardous substances*
1246, 1245, 1244, 1243, 1242, 1239, 1241	*PCB*	*-*	*2*	*5*	*PCB*	*Other relevant substances*

Appendix 2:

Percentage of sites that have quantified the substance at least 3 times, for each substance

(in descending order of percentage)

Substances	SANDRE codes	Number of analyses	Number of sites with at least 3 measurements	Number of sites with at least 3 measurements quantified	% of sites that quantified the substance at least 3 times (out of the total that measured it at least 3 times)
Zinc and its compounds	1383	23157	3560	3333	94
Nonylphenols	6598	18689	2945	2390	81
Copper and its compounds	1392	22584	3481	2796	80
p-octylphenols (mixture)	6600	7425	1174	798	68
Chromium and its compounds	1389	20606	3204	1977	62
Nickel and its compounds	1386	22265	3438	1791	52
Decabromodiphenyl ether (BDE-209)	1815	3588	598	270	45
Chloroform	1135	18899	2965	1317	44
Fluoranthene	1191	18450	2907	1157	40
2,4,6-Trichlorophenol	1549	2834	455	181	40
Monobutyltin cation	2542	13576	2280	833	37
Tributyl phosphate	1847	5666	859	301	35
Lead and its compounds	1382	20619	3251	1070	33
Naphthalene	1517	18211	2900	928	32
2-Chlorophenol	1471	1367	219	68	31
Biphenyl	1584	1795	284	87	31
2,4-Dichlorophenol	1486	522	74	22	30
4-Chloro-3-methylphenol	1636	754	112	32	29
Diuron	1177	2898	451	125	28
Toluene	1278	8962	1465	406	28
Acenaphthene	1453	921	122	33	27
Arsenic and its compounds	1369	11990	1869	483	26
Xylenes (total o, m, p)	1780	2844	454	109	24
Benzo(b)fluoranthene	1116	1994	278	65	23
4-Chlorophenol	1650	628	90	21	23
Tetrabromodiphenyl ether BDE-47	2919	3629	607	132	22
NP1OE	6366	15217	2399	513	21
Pentabromodiphenyl ether (BDE-99)	2916	4089	695	148	21
Isoproturon	1208	2375	370	77	21
Dibutyltin cation	7074	13101	2228	429	19
Heptabromodiphenyl ether BDE-153	2912	3607	604	115	19
Heptabromodiphenyl ether BDE-183	2910	3494	588	110	19
Anthracene	1458	9796	1524	285	19

Substances	SANDRE codes	Number of analyses	Number of sites with at least 3 measurements	Number of sites with at least 3 measurements quantified	% of sites that quantified the substance at least 3 times (out of the total that measured it at least 3 times)
Pentabromodiphenyl ether (BDE-100)	2915	4067	692	129	19
Atrazine	1107	1799	276	51	18
Benzo(a)pyrene	1115	1849	263	48	18
Heptabromodiphenyl ether BDE-154	2911	3590	599	109	18
OP1OE	6370	6714	1055	181	17
OP2OE	6371	6727	1055	175	17
Simazine	1263	1685	260	43	17
Ethylbenzene	1497	2726	465	76	16
4-Chlorotoluene	1600	230	31	5	16
1,2-Dichlorobenzene	1165	383	50	8	16
NP2OE	6369	15211	2398	381	16
1,2-Dichloroethane	1161	992	131	20	15
Benzene	1114	3542	538	81	15
2-Chlorotoluene	1602	253	35	5	14
Chlorobenzene	1467	617	92	13	14
Benzo(ghi)perylene	1118	1911	271	36	13
Pentachlorophenol	1235	4880	771	91	12
Indeno(1,2,3-cd)pyrene	1204	1813	257	30	12
Tetrachlorethylene	1272	8379	1281	149	12
Isopropylbenzene	1633	684	105	12	11
Methylene chloride	1168	5901	966	106	11
Benzo(k)fluoranthene	1117	1744	250	25	10
1,4-Dichlorobenzene	1166	351	46	4	9
Cadmium and its compounds	1388	16588	2720	228	8
1, 1, 1-Trichloroethane	1284	477	61	5	8
4-Chloroaniline	1591	532	74	6	8
2-Chloroaniline	1593	538	75	6	8
1,2,4,5-Tetrachlorobenzene	1631	501	64	5	8
3-Chlorophenol	1651	576	81	6	7
Trichlorethylene	1286	12300	2001	145	7
Vinyl chloride	1753	401	56	4	7
1,2-Dichloroethylene	1163	327	43	3	7
gamma isomer Lindane	1203	1829	289	20	7
1,3-Dichlorobenzene	1164	352	46	3	7
Chloroacetic acid	1465	3218	575	37	6

Substances	SANDRE codes	Number of analyses	Number of sites with at least 3 measurements	Number of sites with at least 3 measurements quantified	% of sites that quantified the substance at least 3 times (out of the total that measured it at least 3 times)
Tributyltin cation	2879	12582	2161	122	6
Mercury and its compounds	1387	17185	2834	154	5
PCB 153	1245	736	112	6	5
Chloroalcanes C10-C13	1955	4727	740	39	5
Pentachlorobenzene	1888	1261	191	10	5
PCB 101	1242	504	70	3	4
Nitrobenzene	2614	331	48	2	4
1-Chloro-2-nitrobenzene	1469	570	80	3	4
1,1,2,2-Tetrachloroethane	1271	435	59	2	3
PCB 52	1241	422	59	2	3
1, 1, 2-Trichloroethane	1285	486	62	2	3
3-Chlorotoluene	1601	230	31	1	3
PCB 138	1244	437	63	2	3
3-Chloroaniline	1592	508	70	2	3
Hexachloroethane	1656	300	40	1	3
Hexachlorobutadiene	1652	810	121	3	2
3,4-Dichloroaniline	1586	600	81	2	2
2-Nitrotoluene	2613	345	47	1	2
Carbon tetrachloride	1276	8628	1537	32	2
Hexachlorobenzene	1199	4317	730	15	2
2,4,5-Trichlorophenol	1548	485	62	1	2
PCB 180	1246	431	63	1	2
PCB 118	1243	451	66	1	2
alpha-Endosulfan	1178	509	67	1	1
beta-Endosulfan	1179	509	67	1	1
Triphenyltin cation	6372	465	67	1	1
1,2,4-Trichlorobenzene	1283	517	68	1	1
Chlorpyrifos	1083	516	69	1	1
1,2,3-Trichlorobenzene	1630	554	74	1	1
1-Chloro-4-nitrobenzene	1470	571	79	1	1
Alachlor	1101	671	85	1	1
alpha-Hexachlorocyclohexane	1200	2407	375	4	1
PCB 28	1239	422	60	0	0
Epichlorohydrin	1494	399	59	0	0
1,1-Dichloroethylene	1162	505	57	0	0
Hexachloropentadiene	2612	515	69	0	0

Substances	SANDRE codes	Number of analyses	Number of sites with at least 3 measurements	Number of sites with at least 3 measurements quantified	% of sites that quantified the substance at least 3 times (out of the total that measured it at least 3 times)
Chlorfenvinphos	1464	561	73	0	0
1,1-Dichloroethane	1160	439	56	0	0
3-Chloroprene (Allyl chloride)	2065	508	73	0	0
1-Chloro-3-nitrobenzene	1468	557	77	0	0
Chloroprene	2611	460	64	0	0
Trifluralin	1289	404	55	0	0
4-Chloro-2-nitroaniline	1594	466	62	0	0
1,3,5-Trichlorobenzene	1629	528	71	0	0

Appendix 3:

Distribution of the weighted average concentrations by flow rates (in µg/l), for each substance

(in descending order on the 90th percentile value)

Substance	SANDRE codes	25th Percentile of the WAC (µg/l)	50th Percentile of the WAC (µg/l)	75th Percentile of the WAC (µg/l)	90th Percentile of the WAC (µg/l)	Maximum of the WACs (µg/l)	"Circular" QL (µg/l)
Zinc and its compounds	1383	33	109	287	731	47 273	10
Copper and its compounds	1392	6	19	54	154	46 990	5
Nickel and its compounds	1386	< QL	< QL	23	126	183 276	10
Chromium and its compounds	1389	< QL	6	18	77	149 660	5
Chloroform	1135	< QL	< QL	5	29	33 264	1
Xylenes (total o, m, p)	1780	< QL	< QL	< QL	25	23 339	2
Lead and its compounds	1382	< QL	< QL	6	20	299 802	5
Toluene	1278	< QL	< QL	2	17	208 997	1
Arsenic and its compounds	1369	< QL	< QL	< QL	16	1 358	5
Methylene chloride	1168	< QL	< QL	< QL	10	232 260	5
Nonylphenols	6598	< QL	0.4	2	5	20 149	0.1
4-Chloro-3-methylphenol	1636	< QL	< QL	< QL	3	4 932	0.1
Benzene	1114	< QL	< QL	< QL	3	8 758	1
Ethylbenzene	1497	< QL	< QL	< QL	3	3 660	1
1,2-Dichloroethane	1161	< QL	< QL	< QL	3	1 254	2
Chlorobenzene	1467	< QL	< QL	< QL	2	12 629	1
NP1OE	6366	< QL	< QL	0.2	1	1 854	0.1
Tributyl phosphate	1847	< QL	< QL	0.2	0.9	2 295	0.1
NP2OE	6369	< QL	< QL	0.1	0.8	1 024	0.1
Tetrachlorethylene	1272	< QL	< QL	< QL	0.8	8 320	0.5
2,4,6-Trichlorophenol	1549	< QL	< QL	0.2	0,6	21	0.1
Biphenyl	1584	< QL	< QL	0,09	0,6	1 071	0.05
Decabromodiphenyl ether (BDE-209)	1815	< QL	< QL	0.1	0.5	210	0.05
2-Chlorophenol	1471	< QL	< QL	0.1	0.5	52	0.1
OP2OE	6371	< QL	< QL	< QL	0.5	2 832	0.1
p-octylphenols (mixture)	6600	< QL	< QL	0.1	0.5	4 305	0.1
OP1OE	6370	< QL	< QL	< QL	0.4	2 005	0.1
Diuron	1177	< QL	< QL	0,06	0.4	1 403	0.05
2,4-Dichlorophenol	1486	< QL	< QL	< QL	0.4	877	0.1
4-Chlorophenol	1650	< QL	< QL	< QL	0,3	118	0.1
Naphthalene	1517	< QL	< QL	0,08	0,3	7 125	0.05
Isoproturon	1208	< QL	< QL	< QL	0.2	164	0.05
Monobutyltin cation	2542	< QL	< QL	0.05	0.2	159	0.02
Pentachlorophenol	1235	< QL	< QL	< QL	0.1	302	0.1
Fluoranthene	1191	< QL	< QL	0.03	0.1	426	0.01
Dibutyltin cation	7074	< QL	< QL	0.02	0,08	107	0.02
Acenaphthene	1453	< QL	< QL	< QL	0,08	19	0.01
Atrazine	1107	< QL	< QL	< QL	0,07	97	0.03
Simazine	1263	< QL	< QL	< QL	0,06	48	0.03
Benzo(b)fluoranthene	1116	< QL	< QL	< QL	0.05	205	0.01

Substance	SANDRE codes	25th Percentile of the WAC (µg/l)	50th Percentile of the WAC (µg/l)	75th Percentile of the WAC (µg/l)	90th Percentile of the WAC (µg/l)	Maximum of the WACs (µg/l)	"Circular" QL (µg/l)
Anthracene	1458	< QL	< QL	< QL	0.04	125	0.01
Benzo(a)pyrene	1115	< QL	< QL	< QL	0.03	183	0.01
Tributyltin cation	2879	< QL	< QL	< QL	0.03	4	0.02
Benzo(ghi)perylene	1118	< QL	< QL	< QL	0.02	108	0.01
Indeno(1,2,3-cd)pyrene	1204	< QL	< QL	< QL	0.02	142	0.01
Benzo(k)fluoranthene	1117	< QL	< QL	< QL	0.02	83	0.01
Chloroalcanes C10-C13	1955	< QL	< QL	< QL	< QL	31 286	10
Trichlorethylene	1286	< QL	< QL	< QL	< QL	3 902	0.5
Cadmium and its compounds	1388	< QL	< QL	< QL	< QL	985	2
Vinyl chloride	1753	< QL	< QL	< QL	< QL	760	5
Chloroacetic acid	1465	< QL	< QL	< QL	< QL	566	25
Nitrobenzene	2614	< QL	< QL	< QL	< QL	336	0.2
2-Chloroaniline	1593	< QL	< QL	< QL	< QL	321	0.1
1,2-Dichlorobenzene	1165	< QL	< QL	< QL	< QL	293	1
1, 1, 2-Trichloroethane	1285	< QL	< QL	< QL	< QL	284	1
Carbon tetrachloride	1276	< QL	< QL	< QL	< QL	253	0.5
4-Chloroaniline	1591	< QL	< QL	< QL	< QL	244	0.1
2-Chlorotoluene	1602	< QL	< QL	< QL	< QL	199	1
1,4-Dichlorobenzene	1166	< QL	< QL	< QL	< QL	183	1
4-Chlorotoluene	1600	< QL	< QL	< QL	< QL	173	1
2-Nitrotoluene	2613	< QL	< QL	< QL	< QL	166	0.2
1-Chloro-2-nitrobenzene	1469	< QL	< QL	< QL	< QL	134	0.1
Isopropylbenzene	1633	< QL	< QL	< QL	< QL	69	1
1,2-Dichloroethylene	1163	< QL	< QL	< QL	< QL	43	5
Mercury and its compounds	1387	< QL	< QL	< QL	< QL	39	0.5
2,4,5-Trichlorophenol	1548	< QL	< QL	< QL	< QL	35	0.1
Chloroprene	2611	< QL	< QL	< QL	< QL	29	1
1, 1, 1-Trichloroethane	1284	< QL	< QL	< QL	< QL	25	0.5
3,4-Dichloroaniline	1586	< QL	< QL	< QL	< QL	23	0.1
3-Chloroaniline	1592	< QL	< QL	< QL	< QL	22	0.1
3-Chlorophenol	1651	< QL	< QL	< QL	< QL	14	0.1
Epichlorohydrin	1494	< QL	< QL	< QL	< QL	14	0.5
Heptabromodiphenyl ether BDE-183	2910	< QL	< QL	< QL	< QL	10	0.05
Heptabromodiphenyl ether BDE-153	2912	< QL	< QL	< QL	< QL	10	0.05
Heptabromodiphenyl ether BDE-154	2911	< QL	< QL	< QL	< QL	10	0.05
Pentabromodiphenyl ether (BDE-100)	2915	< QL	< QL	< QL	< QL	10	0.05
Pentabromodiphenyl ether (BDE-99)	2916	< QL	< QL	< QL	< QL	10	0.05
Tetrabromodiphenyl ether BDE-47	2919	< QL	< QL	< QL	< QL	10	0.05

Substance	SANDRE codes	25th Percentile of the WAC (µg/l)	50th Percentile of the WAC (µg/l)	75th Percentile of the WAC (µg/l)	90th Percentile of the WAC (µg/l)	Maximum of the WACs (µg/l)	"Circular" QL (µg/l)
1,2,4-Trichlorobenzene	1283	< QL	< QL	< QL	< QL	7	1
1,1-Dichloroethane	1160	< QL	< QL	< QL	< QL	7	5
Trifluralin	1289	< QL	< QL	< QL	< QL	6	0.05
1,1-Dichloroethylene	1162	< QL	< QL	< QL	< QL	6	2.5
1,1,2,2-Tetrachloroethane	1271	< QL	< QL	< QL	< QL	4	1
Hexachlorobutadiene	1652	< QL	< QL	< QL	< QL	4	0.5
Chlorpyrifos	1083	< QL	< QL	< QL	< QL	4	0.05
3-Chlorotoluene	1601	< QL	< QL	< QL	< QL	4	1
1,3-Dichlorobenzene	1164	< QL	< QL	< QL	< QL	3	1
alpha-Endosulfan	1178	< QL	< QL	< QL	< QL	3	0.02
Alachlor	1101	< QL	< QL	< QL	< QL	3	0.02
3-Chloroprene (Allyl chloride)	2065	< QL	< QL	< QL	< QL	3	1
1,2,3-Trichlorobenzene	1630	< QL	< QL	< QL	< QL	3	1
beta-Endosulfan	1179	< QL	< QL	< QL	< QL	2	0.02
Hexachloroethane	1656	< QL	< QL	< QL	< QL	2	1
Hexachlorobenzene	1199	< QL	< QL	< QL	< QL	2	0.01
PCB 153	1245	< QL	< QL	< QL	< QL	2	0.01
1,3,5-Trichlorobenzene	1629	< QL	< QL	< QL	< QL	2	1
1,2,4,5-Tetrachlorobenzene	1631	< QL	< QL	< QL	< QL	2	0.05
Pentachlorobenzene	1888	< QL	< QL	< QL	< QL	1	0.02
alpha-Hexachlorocyclohexane	1200	< QL	< QL	< QL	< QL	1	0.02
1-Chloro-4-nitrobenzene	1470	< QL	< QL	< QL	< QL	0.8	0.1
gamma isomer Lindane	1203	< QL	< QL	< QL	< QL	0.8	0.02
1-Chloro-3-nitrobenzene	1468	< QL	< QL	< QL	< QL	0,6	0.1
Chlorfenvinphos	1464	< QL	< QL	< QL	< QL	0,6	0.05
Hexachloropentadiene	2612	< QL	< QL	< QL	< QL	0.5	0.1
Triphenyltin cation	6372	< QL	< QL	< QL	< QL	0.2	0.02
4-Chloro-2-nitroaniline	1594	< QL	< QL	< QL	< QL	0.1	0.1
PCB 101	1242	< QL	< QL	< QL	< QL	0,06	0.01
PCB 180	1246	< QL	< QL	< QL	< QL	0.04	0.01
PCB 52	1241	< QL	< QL	< QL	< QL	0.03	0.01
PCB 138	1244	< QL	< QL	< QL	< QL	0.02	0.01
PCB 28	1239	< QL	< QL	< QL	< QL	0.02	0.01
PCB 118	1243	< QL	< QL	< QL	< QL	0.01	0.01

Appendix 4:

Distribution of average flows (in m^3/d) measured over all the points of release, for each industrial sector

(in descending order on the 90th percentile value)

Sectors	Number of sites	50th Percentile of flow rates (m^3/d)	75th Percentile of flow rates (m^3/d)	90th Percentile of flow rates (m^3/d)	Maximum flow rates (m^3/d)
13.1 Preparation of chemical pulp	4	35457	43090	58063	65814
2.1 Refineries	14	8658	14579	37120	102635
14.1 Steel industry	40	850	2908	9135	78594
9 Pigment manufacturing	5	474	2109	8606	10749
13.3 Paper/cardboard manufacturing	93	1684	4314	8581	53491
6 Chemicals industry	341	194	1513	7805	720000
5 Thermal power plants for electricity generation	33	616	2996	7184	37999
2.3 Oil industries: petroleum product blending and packaging sites	4	17	328	3110	3940
14.2 Ferrous metal foundries	17	599	1303	3012	10992
3.5 Other non-hazardous waste treatment sites	90	48	285	2715	23551
18.2 Agri-food industry (Products of plant origin) excluding wine production	383	155	666	1786	32108
11 Rubber industry	30	191	495	1694	7019
14.4 Production and/or processing of non-ferrous metals	59	37	247	1692	67200
12.1 Finishing	70	319	731	1199	7771
17 Agri-food industry (Products of animal origin)	598	142	424	1045	7578
2.2 Oil depots and terminals	37	64	217	960	264000
4.1 Glass melting	32	118	387	883	12671
4.2 Crystal glass-making factories	2	69	814	868	984
1 Slaughterhouses	195	169	412	765	4016
3.3 Household waste incineration plant	49	118	331	749	2621
22 Wood industry	27	20	287	603	1001
24 Animal by-product treatment industries	17	76	447	589	4116
13.2 Preparation of non-chemical pulp	3	276	448	565	792
7 Glues and adhesives manufacturing	6	6	205	559	1070
19 Hides and skins processing industry	24	81	151	470	1367
14.3 Non-ferrous metal foundries	33	44	226	410	4735
23 Ceramics and refractory materials industry	18	18	159	391	7795
12.2 Commercial laundry	157	143	263	379	665
15 Pharmaceutical industry: Galenic formulation of pharmaceutical products	45	71	166	371	1506
3.1 Grouping, pre-treatment or treatment of hazardous waste	99	48	122	318	4277
20 Mechanical working of metals industry	282	20	90	315	13896
10 Plastic industry	63	40	175	312	23601
21 Processing and surface coating industry	396	25	86	233	7106
4.3 Other glass industry activities	35	55	120	206	2008
3.2 Non-hazardous waste storage facilities	186	33	84	180	4800
16 Printing industry	18	13	29	152	2328

Sectors	Number of sites	50th Percentile of flow rates (m^3/d)	75th Percentile of flow rates (m^3/d)	90th Percentile of flow rates (m^3/d)	Maximum flow rates (m^3/d)
18.1 Wine production	146	34	72	145	756
3.4 Washing of cisterns	39	35	56	93	200
25 Plum drying plants	20	12	26	78	566
8 Paint manufacturing	9	6	26	37	63
2.4 Oil industries: sites for the synthesis or processing of petroleum products (excluding petrochemicals)	3	8	15	25	27

Appendix 5:
Distribution of average daily flows (in g/d), for each substance (in descending order on the 90th percentile value)

Substances	SANDRE codes	25th Percentile of average flows (g/d)	50th Percentile of average flows (g/d)	75th Percentile of average flows (g/d)	90th Percentile of average flows (g/d)	Maximum of average flows (g/d)	Long-term monitoring threshold (g/d)	Reduction study threshold (g/d)
Zinc and its compounds	1383	2	13	53	160	37 620	200	500
Copper and its compounds	1392	0.1	1	7	30	3 618	200	500
Nickel and its compounds	1386	0	0	2	16	6 662	20	100
Chromium and its compounds	1389	0	0.2	2	11	81 365	200	500
Chloroform	1135	0	0	0.7	6	8 520	20	100
Lead and its compounds	1382	0	0	0.1	2	73 839	20	100
Xylenes (total o, m, p)	1780	0	0	0	2	4 097	300	500
Toluene	1278	0	0	0.05	2	11 262	300	1000
Arsenic and its compounds	1369	0	0	0	2	2 413	10	100
Nonylphenols	6598	0.0002	0.03	0.2	1	508	2	10
Methylene chloride	1168	0	0	0	0,6	10 233	20	100
4-Chloro-3-methylphenol	1636	0	0	0	0,6	4 869	300	500
Chlorobenzene	1467	0	0	0	0,3	698	300	1000
Nonylphenol ethoxylates	6366, 6369	0	0	0.02	0,3	537	2	10
Benzene	1114	0	0	0	0.2	11 130	20	100
Tributyl phosphate	1847	0	0	0.01	0.2	3 434	300	2000
Ethylbenzene	1497	0	0	0	0.2	491	300	1000
Biphenyl	1584	0	0	0,008	0.1	369	300	2000
2,4,6-Trichlorophenol	1549	0	0	0.03	0.1	12	300	500
NP1OE	6366	0	0	0,009	0.1	166	-	-
NP2OE	6369	0	0	0,005	0.1	537	-	-
2-Chlorophenol	1471	0	0	0.01	0.1	5	300	500
Brominated diphenyl ethers	1815, 2910, 2912, 2919, 2911, 2916, 2915	0	0	0,006	0,09	59	2	5
Decabromodiphenyl ether (BDE-209)	1815	0	0	0,009	0,09	59	-	-
4-Chlorophenol	1650	0	0	0	0.05	24	300	500
Octylphenol ethoxylates	6370, 6371	0	0	0,004	0.05	6 526	10	30
Naphthalene	1517	0	0	0,005	0.05	796	20	100
2,4-Dichlorophenol	1486	0	0	6E-06	0.04	6 272	300	500
OP2OE	6371	0	0	2E-05	0.03	3 821	-	-
Monobutyltin cation	2542	0	0	0,003	0.03	12	300	500
Diuron	1177	0	0	0.001	0.03	338	4	30
p-octylphenols (mixture)	6600	0	0	0.0002	0.02	46	10	30
Tetrachlorethylene	1272	0	0	0	0.02	2 076	2	5

Substances	SANDRE codes	25th Percentile of average flows (g/d)	50th Percentile of average flows (g/d)	75th Percentile of average flows (g/d)	90th Percentile of average flows (g/d)	Maximum of average flows (g/d)	Long-term monitoring threshold (g/d)	Reduction study threshold (g/d)
Fluoranthene	1191	0	0	0,003	0.02	107	4	30
Benzo(b)fluoranthene	1116	0	0	0.0001	0.02	24	2	10
Acenaphthene	1453	0	0	0	0.02	27	300	500
OP1OE	6370	0	0	0	0.02	2 705	-	-
Atrazine	1107	0	0	0	0.02	2	4	30
Benzo(ghi)perylene	1118	0	0	0	0.01	13	2	10
Benzo(a)pyrene	1115	0	0	0	0.01	22	2	10
Isoproturon	1208	0	0	0	0,009	53	4	30
Indeno(1,2,3-cd)pyrene	1204	0	0	0	0,008	17	2	10
Dibutyltin cation	7074	0	0	0.0002	0,008	32	300	500
Simazine	1263	0	0	0	0,008	16	4	30
Anthracene	1458	0	0	1E-04	0,005	57	2	10
Pentachlorophenol	1235	0	0	0	0,005	559	4	30
Benzo(k)fluoranthene	1117	0	0	0	0,005	10	2	10
Tributyltin cation	2879	0	0	0	0.001	0.8	2	5
3-Chlorophenol	1651	0	0	0	0,0009	9	300	500
PCB	1246, 1245, 1244, 1243, 1242, 1239, 1241	0	0	0	3E-05	1	2	5
Chloroalcanes C10-C13	1955	0	0	0	0	7 034	2	10
Vinyl chloride	1753	0	0	0	0	6 462	300	500
2-Nitrotoluene	2613	0	0	0	0	3 516	300	1000
1,2-Dichloroethane	1161	0	0	0	0	2 197	20	100
1, 1, 2-Trichloroethane	1285	0	0	0	0	1 819	300	2000
Trichlorethylene	1286	0	0	0	0	1 215	2	5
1,2,4-Trichlorobenzene	1283	0	0	0	0	981	4	30
1, 1, 1-Trichloroethane	1284	0	0	0	0	936	300	1000
Chloroacetic acid	1465	0	0	0	0	333	300	500
1,2,3-Trichlorobenzene	1630	0	0	0	0	331	4	30
1,2-Dichlorobenzene	1165	0	0	0	0	294	300	500
1,1,2,2-Tetrachloroethane	1271	0	0	0	0	288	300	2000
Hexachloroethane	1656	0	0	0	0	264	300	1000
2-Chloroaniline	1593	0	0	0	0	253	300	500
Cadmium and its compounds	1388	0	0	0	0	243	2	10
Hexachlorobutadiene	1652	0	0	0	0	204	2	10
3,4-Dichloroaniline	1586	0	0	0	0	165	300	500
Carbon tetrachloride	1276	0	0	0	0	156	2	5
1,4-Dichlorobenzene	1166	0	0	0	0	133	300	500

Substances	SANDRE codes	25th Percentile of average flows (g/d)	50th Percentile of average flows (g/d)	75th Percentile of average flows (g/d)	90th Percentile of average flows (g/d)	Maximum of average flows (g/d)	Long-term monitoring threshold (g/d)	Reduction study threshold (g/d)
Mercury and its compounds	1387	0	0	0	0	92	2	5
4-Chloroaniline	1591	0	0	0	0	88	300	500
Pentachlorobenzene	1888	0	0	0	0	71	2	5
Hexachlorocyclohexane	1200 ,1203	0	0	0	0	49	2	5
1,3-Dichlorobenzene	1164	0	0	0	0	48	300	500
2-Chlorotoluene	1602	0	0	0	0	32	300	500
1,2-Dichloroethylene	1163	0	0	0	0	31	300	2000
1-Chloro-4-nitrobenzene	1470	0	0	0	0	28	300	500
4-Chlorotoluene	1600	0	0	0	0	27	300	500
alpha-Hexachlorocyclohexane	1200	0	0	0	0	27	-	-
1,2,4,5-Tetrachlorobenzene	1631	0	0	0	0	27	300	500
Nitrobenzene	2614	0	0	0	0	22	300	1000
gamma isomer Lindane	1203	0	0	0	0	22	2	5
Isopropylbenzene	1633	0	0	0	0	18	300	1000
Hexachlorobenzene	1199	0	0	0	0	14	2	5
1-Chloro-2-nitrobenzene	1469	0	0	0	0	9	300	500
Chloroprene	2611	0	0	0	0	7	300	1000
Chlorpyrifos	1083	0	0	0	0	6	4	100
Epichlorohydrin	1494	0	0	0	0	5	300	500
3-Chloroaniline	1592	0	0	0	0	5	300	500
alpha-Endosulfan	1178	0	0	0	0	5	2	5
beta-Endosulfan	1179	0	0	0	0	4	2	5
1,1-Dichloroethylene	1162	0	0	0	0	2	300	2000
1,1-Dichloroethane	1160	0	0	0	0	2	300	2000
2,4,5-Trichlorophenol	1548	0	0	0	0	2	300	500
3-Chlorotoluene	1601	0	0	0	0	1	300	500
3-Chloroprene (Allyl chloride)	2065	0	0	0	0	0,6	300	1000
1,3,5-Trichlorobenzene	1629	0	0	0	0	0.4	4	30
Pentabromodiphenyl ether (BDE-99)	2916	0	0	0	0	0.4	2	5
PCB 180	1246	0	0	0	0	0,3	-	-
PCB 153	1245	0	0	0	0	0,3	-	-
PCB 138	1244	0	0	0	0	0.2	-	-
Alachlor	1101	0	0	0	0	0.2	4	100
Tetrabromodiphenyl ether BDE-47	2919	0	0	0	0	0.2	-	-
Heptabromodiphenyl ether BDE-153	2912	0	0	0	0	0.2	-	-

Substances	SANDRE codes	25th Percentile of average flows (g/d)	50th Percentile of average flows (g/d)	75th Percentile of average flows (g/d)	90th Percentile of average flows (g/d)	Maximum of average flows (g/d)	Long-term monitoring threshold (g/d)	Reduction study threshold (g/d)
Pentabromodiphenyl ether (BDE-100)	2915	0	0	0	0	0.2	2	5
Heptabromodiphenyl ether BDE-183	2910	0	0	0	0	0.2	-	-
Heptabromodiphenyl ether BDE-154	2911	0	0	0	0	0.2	-	-
Hexachloropentadiene	2612	0	0	0	0	0.1	300	1000
Trifluralin	1289	0	0	0	0	0.1	4	100
PCB 101	1242	0	0	0	0	0.1	-	-
PCB 28	1239	0	0	0	0	0,06	-	-
Triphenyltin cation	6372	0	0	0	0	0.05	300	500
Chlorfenvinphos	1464	0	0	0	0	0.03	4	100
1-Chloro-3-nitrobenzene	1468	0	0	0	0	0.03	300	500
4-Chloro-2-nitroaniline	1594	0	0	0	0	0.01	300	500
PCB 52	1241	0	0	0	0	0.01	-	-
PCB 118	1243	0	0	0	0	0,002	-	-

Appendix 6:

Number of sites under long-term monitoring and reduction studies, for each substance

(in descending order of the number of sites under a reduction study)

Substances	SANDRE codes	Number of sites under long-term monitoring	Number of sites under a reduction study	Number of sites that tested for the substance at least once
Zinc and its compounds	1383	302	121	3633
Nickel and its compounds	1386	303	99	3539
Linear or branched nonylphenols	6598	216	62	3104
Chloroform	1135	131	34	3069
Tetrachlorethylene	1272	39	27	1432
Lead and its compounds	1382	86	25	3394
Copper and its compounds	1392	71	23	3575
Methylene chloride	1168	41	23	1106
Nonylphenol ethoxylates	6366, 6369	61	21	2557
Chromium and its compounds	1389	38	19	3333
Cadmium and its compounds	1388	48	16	2867
Chloroalcanes C10-C13	1955	31	15	874
Arsenic and its compounds	1369	89	14	1986
Trichlorethylene	1286	18	13	2187
Benzene	1114	16	12	622
Toluene	1278	19	11	1564
1,2-Dichloroethane	1161	13	10	236
Mercury and its compounds	1387	17	8	2981
Brominated diphenyl ethers	1815, 2910, 2912, 2919, 2911, 2916, 2915	10	8	1025
Naphthalene	1517	16	6	3043
Carbon tetrachloride	1276	7	6	1684
Xylenes (total o, m, p)	1780	6	6	530
Octylphenol ethoxylates	6370, 6371	5	4	1171
Anthracene	1458	9	3	1666
Hexachlorobenzene	1199	4	3	849
p-octylphenols (mixture)	6600	3	3	1306
Fluoranthene	1191	16	2	3046
Diuron	1177	4	2	544
Hexachlorobutadiene	1652	4	2	200
Isoproturon	1208	4	2	468
Hexachlorocyclohexane	1200 ,1203	3	2	553
Vinyl chloride	1753	2	2	126
Pentachlorobenzene	1888	2	2	307
Benzo(a)pyrene	1115	6	1	341
Benzo(b)fluoranthene	1116	5	1	349
Benzo(ghi)perylene	1118	4	1	350

Substances	SANDRE codes	Number of sites under long-term monitoring	Number of sites under a reduction study	Number of sites that tested for the substance at least once
Indeno(1,2,3-cd)pyrene	1204	3	1	343
Pentachlorophenol	1235	3	1	899
2-Nitrotoluene	2613	2	1	104
gamma isomer Lindane	1203	2	1	386
Tributyl phosphate	1847	2	1	961
1,2,3-Trichlorobenzene	1630	1	1	145
1,2,4-Trichlorobenzene	1283	1	1	139
2,4-Dichlorophenol	1486	1	1	151
4-Chloro-3-methylphenol	1636	1	1	210
Chlorobenzene	1467	2	0	161
Ethylbenzene	1497	2	0	549
1, 1, 1-Trichloroethane	1284	1	0	160
1, 1, 2-Trichloroethane	1285	1	0	171
Chloroacetic acid	1465	1	0	703
alpha-Endosulfan	1178	1	0	163
Benzo(k)fluoranthene	1117	1	0	334
beta-Endosulfan	1179	1	0	163
Biphenyl	1584	1	0	363
Chlorpyrifos	1083	1	0	159
Simazine	1263	1	0	372
1,1-Dichloroethane	1160	0	0	161
1,1-Dichloroethylene	1162	0	0	164
1,1,2,2-Tetrachloroethane	1271	0	0	151
1,2-Dichlorobenzene	1165	0	0	122
1,2-Dichloroethylene	1163	0	0	118
1,2,4,5-Tetrachlorobenzene	1631	0	0	169
1,3-Dichlorobenzene	1164	0	0	117
1,3,5-Trichlorobenzene	1629	0	0	142
1,4-Dichlorobenzene	1166	0	0	117
1-Chloro-2-nitrobenzene	1469	0	0	190
1-Chloro-3-nitrobenzene	1468	0	0	189
1-Chloro-4-nitrobenzene	1470	0	0	190
2-Chloroaniline	1593	0	0	180
2-Chlorophenol	1471	0	0	320
2,4,5-Trichlorophenol	1548	0	0	170
2,4,6-Trichlorophenol	1549	0	0	560
2-Chlorotoluene	1602	0	0	87
3-Chloroaniline	1592	0	0	179
3-Chlorophenol	1651	0	0	179
3,4-Dichloroaniline	1586	0	0	197

Substances	SANDRE codes	Number of sites under long-term monitoring	Number of sites under a reduction study	Number of sites that tested for the substance at least once
3-Chloroprene (Allyl chloride)	2065	0	0	155
3-Chlorotoluene	1601	0	0	84
4-Chloroaniline	1591	0	0	182
4-Chlorophenol	1650	0	0	182
4-Chloro-2-nitroaniline	1594	0	0	168
4-Chlorotoluene	1600	0	0	84
Acenaphthene	1453	0	0	194
Alachlor	1101	0	0	199
Atrazine	1107	0	0	383
Chlorfenvinphos	1464	0	0	168
Chloroprene	2611	0	0	142
Dibutyltin cation	7074	0	0	2414
Epichlorohydrin	1494	0	0	135
Hexachloroethane	1656	0	0	106
Hexachloropentadiene	2612	0	0	180
Isopropylbenzene	1633	0	0	186
Monobutyltin cation	2542	0	0	2443
Nitrobenzene	2614	0	0	105
PCB	1246, 1245, 1244, 1243, 1242, 1239, 1241	0	0	206
Pentabromodiphenyl ether (BDE-100)	2915	0	0	993
Pentabromodiphenyl ether (BDE-99)	2916	0	0	999
Tributyltin cation	2879	0	0	2338
Trifluralin	1289	0	0	148
Triphenyltin cation	6372	0	0	148

Appendix 7:

Total number of long-term monitoring actions and reduction studies, and number of sites involved, by industrial sector

(in descending order of the number of sites by industrial sector)

Secteurs / Sous-secteurs d'activités	Nombre de sites	Nombre total de surveillances pérennes	Nombre total d'études de réduction
17 Industrie agro-alimentaire (Produits d'origine animale)	598	101	14
21 Industrie du traitement, revetement de surface	396	171	67
18.2 Industrie agro-alimentaire (Produits d'origine végétale) hors activité vinicole	383	191	66
6 Industrie de la chimie	341	381	189
20 Industrie du travail mécanique des métaux	282	71	19
1 Abattoirs	195	41	7
3.2 Installations de stockage de déchets non dangereux	186	29	7
12.2 Blanchisseries	157	80	7
18.1 Activité vinicole	146	8	2
3.1 Regroupement, prétraitement ou traitement des déchets dangereux	99	47	13
13.3 Fabrication de papiers/cartons	93	68	30
3.5 Autres sites de traitement de déchets non dangereux	90	35	6
12.1 Ennoblissement	70	72	30
10 Industrie du plastique	63	16	10
14.4 Production et/ou transformation des métaux non ferreux	59	57	23
3.3 Unité d'incinération d'ordures ménagères	49	26	5
15 Industrie pharmaceutique : Formulation galénique de produits pharmaceutiques	45	10	0
14.1 Sidérurgie	40	88	36
3.4 Lavage de citernes	39	11	1
2.2 Dépôts et terminaux pétroliers	37	6	3
4.3 Autres activités de l'industrie du verre	35	5	0
5 Centrales thermiques de production d'électricité	33	21	10
14.3 Fonderies de métaux non ferreux	33	13	4
4.1 Fusion du verre	32	12	4
11 Industrie du caoutchouc	30	18	7
22 Industrie du bois	27	4	2
19 Industrie du traitement des cuirs et peaux	24	13	8
25 Installations de séchage de prunes	20	0	0
16 Industrie de l'imprimerie	18	1	1
23 Industrie de la céramique et des matériaux réfractaires	18	3	0
14.2 Fonderies de métaux ferreux	17	6	2
24 Industries du traitement des sous-produits animaux	17	1	0
2.1 Raffinage	14	47	27
8 Fabrication de peintures	9	0	0
7 Fabrication de colles et adhesifs	6	0	0
9 Fabrication de pigments	5	7	5
13.1 Préparation de pâte chimique	4	16	12
2.3 Industries pétrolières : sites de mélanges et de conditionnement de produits pétroliers	4	0	0
13.2 Préparation de pâte non chimique	3	0	0
2.4 Industries pétrolières : sites de synthèse ou de transformation de produits pétroliers (hors pétrochimie)	3	0	0
4.2 Cristalleries	2	2	1

Colour code:

Sectors in red:	Top 5 sectors in number of sites, representing 50% of sites
Sectors in red and brown:	Top 12 sectors in number of sites, representing 80% of sites
Sectors in dark green and light green:	Last 21 sectors in number of sites, representing 10% of sites
Sectors in light green:	Last 8 sectors in number of sites, with fewer than 10 sites

Appendix 8:

Number of sites affected by at least one long-term monitoring action and a reduction study, and percentage compared to the total number of sites, by industrial sector

(in descending order of the number of sites affected by at least one reduction study)

Secteurs / Sous-secteurs d'activités	Nombre de sites	Nombre de sites en surveillance pérenne	Nombre de sites en étude de réduction	% de sites en surveillance pérenne	% de sites en étude de réduction
6 Industrie de la chimie	341	142	83	42	24
21 Industrie du traitement, revetement de surface	396	119	56	30	14
18.2 Industrie agro-alimentaire (Produits d'origine végétale) hors activité vinicole	383	91	35	24	9
14.1 Sidérurgie	40	30	21	75	53
12.1 Ennoblissement	70	37	19	53	27
13.3 Fabrication de papiers/cartons	93	41	19	44	20
20 Industrie du travail mécanique des métaux	282	52	18	18	6
17 Industrie agro-alimentaire (Produits d'origine animale)	598	80	12	13	2
14.4 Production et/ou transformation des métaux non ferreux	59	21	10	36	17
2.1 Raffinage	14	12	8	86	57
3.1 Regroupement, prétraitement ou traitement des déchets dangereux	99	26	8	26	8
19 Industrie du traitement des cuirs et peaux	24	12	7	50	29
12.2 Blanchisseries	157	50	7	32	4
10 Industrie du plastique	63	8	6	13	10
3.5 Autres sites de traitement de déchets non dangereux	90	22	6	24	7
1 Abattoirs	195	33	6	17	3
11 Industrie du caoutchouc	30	11	5	37	17
5 Centrales thermiques de production d'électricité	33	10	5	30	15
13.1 Préparation de pâte chimique	4	4	4	100	100
14.3 Fonderies de métaux non ferreux	33	9	4	27	12
3.3 Unité d'incinération d'ordures ménagères	49	15	3	31	6
3.2 Installations de stockage de déchets non dangereux	186	16	3	9	2
9 Fabrication de pigments	5	3	2	60	40
14.2 Fonderies de métaux ferreux	17	5	2	29	12
22 Industrie du bois	27	3	2	11	7
18.1 Activité vinicole	146	5	2	3	1
4.2 Cristalleries	2	2	1	100	50
16 Industrie de l'imprimerie	18	1	1	6	6
4.1 Fusion du verre	32	7	1	22	3
2.2 Dépôts et terminaux pétroliers	37	4	1	11	3
3.4 Lavage de citernes	39	9	1	23	3
15 Industrie pharmaceutique : Formulation galénique de produits pharmaceutiques	45	9	0	20	0
23 Industrie de la céramique et des matériaux réfractaires	18	3	0	17	0
4.3 Autres activités de l'industrie du verre	35	4	0	11	0
24 Industries du traitement des sous-produits animaux	17	1	0	6	0
25 Installations de séchage de prunes	20	0	0	0	0
8 Fabrication de peintures	9	0	0	0	0
7 Fabrication de colles et adhesifs	6	0	0	0	0
2.3 Industries pétrolières : sites de mélanges et de conditionnement de produits pétroliers	4	0	0	0	0
13.2 Préparation de pâte non chimique	3	0	0	0	0
2.4 Industries pétrolières : sites de synthèse ou de transformation de produits pétroliers (hors pétrochimie)	3	0	0	0	0

Appendix 9:

Emission limit values (ELVs) of the Ministerial Order of 2 February 1998 regulating the classified facilities subject to authorisation and emission levels associated with the best available techniques (BAT-AELs) of the most recent BREFs

	Arrêté Ministériel du 02/02/1998 [1]		Action RSDE		IED Chimie			IED Métaux ferreux	IED Métaux non ferreux	IED Raffineries	IED Tanneries	IED Verre
Métal	VLE (µg/l) [2]	Conditions de flux (g/j)	Seuil de passage en surveillance pérenne (g/j)	Seuil de passage en étude de réduction (g/j)	BATAEL CWW potentielles (µg/l) (moyenne annuelle) *(source : draft final, 07/2014)*	Conditions de flux (kg/an)	Conditions de flux converties en (g/j)	BATAEL IS (µg/l) (échantillon composite sur 24h (prélèvement continu ou discontinu) ou 2h (constitué d'au moins 5 prélèvements à intervalle d'au moins 2 minutes)*(source : BATC 03/2012)*	BATAEL NFM potentielles (µg/l) (échantillon moyen journalier, prélèvement proportionnel au débit) *(source : Draft final, 10/2014)* [5]	BATAEL REF (µg/l) (moyenne annuelle) *(source : BATC 10/2014)*	BATAEL TAN (µg/l) (moyenne mensuelle) *(source : BATC 02/2013)*	BATAEL GLS (µg/l) (échantillon composite prélevé sur une période de deux heures ou de 24 heures) *(source : BATC 03/2012)*
Zinc	2000	20	200	500	20 - 300	30 kg/an	82	Agglomération : As+Cd+Cr+Cu+Hg+Ni+Pb+Zn 100 Pelletisation : As+Cd+Cr+Cu+Hg+Ni+Pb+Zn 550 Cokéfaction : - Haut fourneaux : Zn : 2000 Convertisseur à O2 : Zn 2000 Aciérie électrique : 2000	1000 (Cu, Pb, Sn, Zn, Cd,Ni, Co, Alliages ferreux) 400 (Mtx précieux)	-	-	< 500
Cuivre	500	5	200	500	5 - 50	Si flux > 5 kg/an	14		1000 (Cu, Pb, Sn, Zn, Cd,Ni, Co, Alliages ferreux) 400 (Mtx précieux)	-	-	< 300
Arsenic	50 [3]	0,5	10	100	-	-	-		1000 (Cu, Pb, Sn, Zn, Cd,Ni, Co, Alliages ferreux) 400 (Mtx précieux)	-	-	< 300
Chrome	500	5	200	500	5 - 25	Si flux > 2,5 kg/an	7	Convertisseur à O2 : 500 Aciérie électrique : 500	200 (Alliages ferreux) (Cr VI < 50) - : (Cu, Pb, Sn, Zn, Cd, Mtx précieux, Ni, Co)	-	< 300 - 1000	< 300
Nickel	500	5	20	100	5 - 50	Si flux > 5 kg/an	14	Convertisseur à O2 : 500 Aciérie électrique : 500	100 (Zn, Cd) 500 (Cu, Pb, Sn, Mtx précieux) 2000 (Ni, Co, Alliages Fe)	5 - 100	-	< 500
Plomb	500	5	20	100	-	-	-	Haut fourneaux : 500	500 (Cu, Pb, Sn, Mtx précieux, Ni, Co) 200 (Zn, Cd, Alliages ferreux)	5 - 30	-	< 50 - 300
Cadmium	- [4]	-	2	10	-	-	-		20 - 100 (Cu) 100 (Pb, Sn, Zn, Cd, Ni, Co) 50 (Mtx précieux, Alliages Fe)	2 - 8	-	< 50
Mercure	- [4]	-	2	5	-	-	-		5 - 20 (Cu) 50 (Pb, Sn, Zn, Cd, Mtx précieux, Ni, Co, Alliages Fe)	0,1 - 1	-	-

(1) Arrêté du 02/02/98 relatif aux prélèvements et à la consommation d'eau ainsi qu'aux émissions de toute nature des installations classées pour la protection de l'environnement soumises à autorisation.
Article 32 - 3

(2) Les VLE reportées ici sont celles concernant tous les sites indifféremment de leur secteur d'activité. D'autres VLE sont définies dans l'arrêté du 02/02/1998 pour certaines activités ou secteurs d'activité en particulier. Celles-ci ne sont pas reportées ici.
Sauf dispositions contraires, les valeurs limites s'imposent à des prélèvements, mesures ou analyses moyens réalisés sur 24 heures.
Elles concernent les rejets directs et indirects au milieu naturel.

(3) La VLE n'est pas spécifique à l'arsenic. Elle est définie pour un ensemble de substances toxiques, bioaccumulables ou nocives pour l'environnement, et s'applique en sortie d'atelier et au rejet final et en flux et concentration cumulés.
La VLE est une valeur limite mensuelle, la valeur limite journalière ne devant pas dépasser 2 fois la valeur limite mensuelle.

(4)Le cadmium et le mercure sont encadrés dans l'article 32-4 par des valeurs limites ciblant spécifiquement certains secteurs en particulier, utilisant ces métaux, directement ou indirectement. Elles constituent également des valeurs de référence pour les autres secteurs d'activité.

Sur les BAT AEL, des restrictions d'applicabilité existent et sont précisées dans les BREF au cas par cas.
Pour certains BREF, il est précisé que les BAT AEL ne concernent que les rejets directs uniquement.

(5) Les BAT AEL sont définies en fonction de l'activité des sites, à savoir selon les métaux produits (métaux donnés entre parenthèses).

Bien que pas toujours comparables car pas toujours sur les mêmes fréquences de mesures, le code couleur utilisé est le suivant :
BATAEL < VLE en valeur absolue
BATAEL = VLE en valeur absolue
BATAEL > VLE en valeur absolue